# The Kyoto Protocol and the APEC economies

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# Acronyms/Abbreviations

| | |
|---|---|
| APEC | Asia-Pacific Economic Cooperation |
| ASEAN | Association of South East Asian Nations |
| BBC | British Broadcasting Corporation |
| BCM | Billion cubic metres |
| BIPV | Building integrated photovolatics |
| CDM | Clean Development Mechanism |
| $CO_2$ | Carbon dioxide |
| COP | Conference of the parties |
| EU | European Union |
| GDP | Gross domestic product |
| GHG | Greenhouse gases |
| GEF | Global Environment Facility |
| Gt | Gigatons |
| IEA | International Energy Agency |
| IPCC | International Panel on Climate Change |
| Ktoe | Kilo ton of oil equivalent |
| OECD | Organisation for Economic Cooperation and Development |
| LULUCF | Land use, land-use change and forestry |
| Mt | Megaton (million tons) |
| Mtoe | Megaton of oil equivalent |
| NGO | Non-governmental organisation |
| PV | Photovoltaic |
| UNDP | United Nations Development Programme |
| TWh | Terra watt hours |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WMO | World Meteorological Organization |
| WTO | World Trade Organisation |

# 1. Introduction

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), was negotiated in 1997 to address climate change brought about by changes in global concentrations of "greenhouse gases."[i] The Kyoto Protocol requires cuts in emissions of greenhouse gases from a range of developed and transition economies that have ratified the treaty.[ii] The cuts must be achieved between 2008 and 2012.[iii] This is called the "first commitment period." The Kyoto Protocol is silent on what happens after the end of the first commitment period.

Developing countries are not required to cut emissions. The Kyoto Protocol enshrines the principle of "common but differentiated responsibilities"[iv] in its approach to managing global climate change. The principle is based on the notion that industrialised economies, having achieved higher levels of development, have a greater responsibility and are better equipped to take on the challenges of reducing emissions than developing countries. The principle also recognises the priority given to development in poorer countries, suggesting that developing countries ought to be protected to some extent from the negative economic effects of emission reductions.

The Kyoto Protocol will shortly come into effect. In addition to getting the institutions of the Protocol established, two other questions come to the fore – what is to be done after 2012; and should developing countries accept obligations to reduce emissions?

The Asia-Pacific Economic Cooperation group, or APEC, is the premier forum for facilitating economic growth, cooperation, trade and investment in the Asia-Pacific region. APEC has 21 member economies, which account for more than a third of the world's population (2.6 billion people), approximately 60% of world GDP (US$19, 254 billion) and about 47% of world trade.[v] It includes the most economically dynamic region in the world having generated nearly 70% of global economic growth in its first 10 years. APEC developing economies include most of the fastest growing economies in the world.[vi]

The APEC developing country economies have had the greatest success in reducing poverty.[vii] They also have the largest demand for power.[viii] The aim of this research paper is to look at the impacts of the Kyoto Protocol on APEC developing economies.

This report does not review debate over the technical basis of the analyses of the International Panel on Climate Change (IPCC, the body appointed by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to assess the scientific basis of human-induced climate change). However, some important new work has raised fresh questions about its dependability.[1] [ix]

1 The scenarios made by the IPCC for changes in temperature due to projected greenhouse gas emissions have been questioned. The IPCC scenarios projected globally averaged surface temperature to increase by between 1.4 and 5.8°C (Houghton *et al*., 2001: 13). The projected rate of increase in global emissions at the higher end of the scale (the one most commonly cited) has been shown to be seriously exaggerated. Work by Ian Castles and David Henderson (see endnote ix in this document for a list of references) shows presumptions about sustained rates of growth among developing countries are unrealistically high and unsupportable by historic experience and data. This matter has been raised with the IPCC (see endnote ix for references to the exchanges between the Castles/Henderson and the IPCC).

A critical piece of analysis in the IPCC report showing temperature in the twentieth century had dramatically spiked has been shown to be wrong. (This spike is commonly referred to as a "hockey stick" trend line). A study by Stephen McIntyre and Ross McKitrick revealed that the model shaped all data examined into this trend. They re-examined the raw data and found the 15th century was warmer than the 20th century (McIntyre & McKitrick, 2003).

# 2. Executive Summary

With the Kyoto Protocol about to come into effect,[2] attention among policy makers is focusing on what do after 2012, when the program of commitments to reduce emissions of greenhouse gases finishes. The APEC region includes the fastest growing developing economies (including China, Korea, and Thailand) which have had the greatest success in reducing poverty. They also have the largest demand for power. What climate change strategies are appropriate for these economies?

The impact of the strategy implicit in the mechanisms of the Kyoto Protocol is to reduce emissions of greenhouse gases by reducing consumption of energy from fossil fuels. With no comparably priced mainstream sources of alternative power (other than nuclear) available, the broad, long-term impact of the strategy will be to slow global economic growth. This will constrain efforts of governments in the developing world to raise living standards.

The direct economic impact on developing economy members of APEC is mixed. For some countries the effect will be negative on GDP growth and terms of trade but for several countries it will be positive on investment. The expectation is that some investment will be diverted to the East Asian economies. The impacts are likely to be small either way because of uncertainty about what action will be taken after 2012.

The Kyoto Protocol does not oblige developing countries to reduce emissions of greenhouse gases. The Protocol instead established mechanisms to provide technical assistance to assist with strategies to reduce production of greenhouse gases. The most tangible activity has been the establishment of the Global Environment Facility (GEF) to fund programs. The focus of the GEF has been on delivery of forms of power in poor economies where energy systems are not well developed. The effectiveness of these programs cannot yet be assessed. The GEF has also supported the introduction of new forms of renewable energy rather than encouraging greater efficiency in combustion and energy use in areas where production and consumption are greatest.

Since economies in East Asia are major consumers of power, projects to promote efficiency in generation of power would have produced greater reductions in emissions of $CO_2$. (Modest programs have been undertaken in China to reduce emissions from combustion of coal and in Thailand to manage demand for power.) This has not been a focus of GEF programs and East Asian economies thereby have not been major recipients of GEF funding.

The Kyoto Protocol will create a Clean Development Mechanism to foster commercial investment in projects that reduce greenhouse gas emissions in developing countries. No programs have been approved for implementation under the Mechanism. It is unlikely any programs which are commercially sustainable will be developed under this Mechanism. The approval processes will deter investment and the conditions on projects (controlled by donors) will make them less attractive to developing countries than either ordinary foreign investments or normal aid projects.

The Protocol also provides for global emissions trading. The idea here was that since most developing countries emit less greenhouse gases than industrialized economies, developing countries should be in a position to sell the rights to rich countries with obligations to reduce greenhouse gases. This would efficiently distribute the cost of controlling emissions throughout the global economy. It is an unrealistic ambition and unlikely to occur. It is very complex and commitment to it is weak. Even if the system were established, developing countries could not participate until they generate tradable permits. This requires commitments to regulate and reduce emissions, which they will not make.

East Asian economies are the fastest growing users of energy. The high rates of economic growth and absolute reduction of poverty they have delivered depend upon increasing generation of electricity and consumption of fossil fuels. The Kyoto strategy presumes industries will switch to renewable energies.

2 While the Russian Government has decided to ratify the Protocol, analysis by Russian experts also summarizes important questions about the science upon which the IPCC report and the Kyoto Protocol are based (Illarionov, 2004).

Other than nuclear, none are capable of providing energy at the same price as fossil fuel.

There is no agreement about international measures to address climate change after 2012. European economies seemed to believe it was implicit in the Kyoto Protocol that developing countries would ultimately cut emissions. There is no formal understanding to that effect. If APEC economies cut emissions as envisaged under Kyoto, the inevitable result would be slower economic growth.

Will APEC economies have to cut emissions to trade with Europe? The EU is restricting trade with countries that do not meet its environmental standards. Grounds for the EU to argue it has rights in international law to restrict trade with countries not reducing emissions of greenhouse gases are weak.

The rate of generation of carbon dioxide among East Asian economies can be significantly reduced through the application of the latest fossil fuel combustion technologies in power generation. In the long term, an effective alternative to the method of capping emission of greenhouse gases as proposed in the Kyoto Protocol is research to develop new technologies for reducing generation and capture of greenhouse gases.

Given that the science and the resulting calculations underpinning the rationale for the Kyoto Protocol are now much less certain, it would make more sense to adopt strategies to develop new technologies which have the effect of reducing emissions, than using the blunt instrument of cutting energy consumption which will constrain growth.

# 3. Impacts on APEC developing economies of emission reductions under the Kyoto Protocol

## Global impacts

The general expectation among economic researchers is that reducing emissions will reduce energy consumption in economies with greenhouse emission targets, which will in turn reduce growth in Europe somewhat and thereby reduce global growth. The impact in the period specified for cuts (2008 – 2012) is likely to be slight because for most developed economies opportunities exist in the short term to offset the impacts of reductions.

It is expected that the direct economic impact on developing economy members of APEC would be mixed. For some countries it will be negative on growth of GDP and terms of trade but for several countries it will be positive on investment. The expectation is that some investment will be diverted to the East Asian economies. The impacts are likely to be small either way because of uncertainty about what action will be taken after 2012.

How much the Kyoto Protocol will cost will depend largely on how the Protocol is implemented. While each country required to make cuts will have a specified target for reductions (based on a percentage of what emissions were in 1990) the Protocol also allows for different ways of meeting commitments.

There are mechanisms that may actually allow some countries (such as Germany) to increase their emissions under the Protocol, rather than reduce them. Aside from permit trading (the effects of which are uncertain and which is dealt with in Section 6) the combined effects of these mechanisms may be to reduce substantially the burden of reducing emissions.[3] This paper does not assess the likelihood of developed countries meeting their targets. In some cases doubts have been raised about the ability of several members of the EU and Japan to do so, despite the various mechanism available to lessen the burden.[4]

Several efforts have been made to cost the impact of the Kyoto Protocol. In 1999 economists presenting 13 different models of the costs of the Kyoto Protocol participated in the Stanford Energy Modeling Forum. Bjørn Lomborg, in *The Skeptical environmentalist* (2001), reported on the averages of the 13 different models reviewed at that Forum. Although their results often diverged by a factor of 2 to 4, they found an average cost to be around US $346 billion a year by 2010. These models assumed that the US took part in the Protocol and that there was no international trading of emission permits. That cost represents around 0.95 percent of global GDP in 2003.[x] This is an annual cost to global growth of significant proportions.

Lomborg points out that while the cut required overall by the Kyoto Protocol is only

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3 The Kyoto Protocol allows countries to group together and meet the total reductions required of those countries, sharing out the reductions across countries in the way that most effectively reduces the burden. This has been dubbed a "bubble" arrangement. Europe will take on a bubble arrangement of this kind, which means that countries that have low targets due to unrelated economic circumstances in 1990 (such as Germany, due to reunification) can make up the shortfall of reductions for other countries. Another phenomenon that complicates costings of the Kyoto Protocol is "hot air." Michaelowa in 2001 wrote (2001: 5) writes "Due to prolonged economic recession, some countries currently have emissions that are lower than their emissions targets and are unlikely to reach the target level during the commitment period. This applies primarily to Russia, Ukraine and some East European states. The difference between the target and the business-as-usual emissions during the commitment period is commonly called 'Hot air.' " The Kyoto Protocol also allows for special reductions due to forestry activities likely to allow greenhouse gases to be stored (known as "sinks".) Called "land use and afforestation (LULUCF)" these provisions allow parties to Kyoto to increase their emissions by increasing the amount of greenhouse gases removed from the atmosphere by so-called carbon "sinks" created by revegetation and reforestation.

4 Japanese Government officials have at various stages since ratifying the Kyoto Protocol indicated that compliance may be difficult for Japan, and that as a result targets for Japanese industry might initially be voluntary. Japanese news reports quote officials stating that it is a distinct possibility that Japan will not reach its first commitment targets and are currently unwilling to further regulate energy producers. This has been reported in the Japanese paper Yomiuri Shimbun, and by the BBC at news.bbc.co.uk/2/hi/sci/tech/1740677.stm. Equally, the EU Commission has cast doubts on Europe's ability to meet its targets. The Commission reports (EEC, 2003: 5) that "aggregate Member States' projections suggest that existing policies and measures will not be sufficient to reach the EC's Kyoto target. The 'with existing measures' projection suggests that in 2010 the emissions of the European Community (EC) will have decreased by only 0.5 % leaving a significant gap of 7.5 % from the Kyoto target. The figure on projected progress for the EU as a whole is considerably worse than the figure given in last year's report (cf. COM(2002)702)."

5.2 percent of 1990 emissions, global growth is likely to drive the magnitude of the cuts closer to 28 percent of business-as-usual emissions in 2010.[5] Lomborg further notes that Nordhaus and Boyer of Yale (whose computer model has been often cited to examine the possible costs of various policy options), estimate both the cost of Kyoto-style intervention as well as the possible cost of global warming itself. The net cost (in 2000 US dollars) is between US$550 and US$900 billion (depending on the cost of warming itself and assuming no "emissions trading"). This means that the cost of the Kyoto Protocol could be higher or even double the cost of the effects of global warming.

If international trading of permits does not occur the cost of the Kyoto Protocol may be vast. Assuming US ratification the costs were modeled at US$ 893 billion per year by 2010,[xi] or 2.5 percent of global GDP in 2003.[xii] Yet Kyoto's impact on concentrations of greenhouse gases would be minimal.[xiii] More ambitious plans to stabilize greenhouse gas emissions following the Protocol model would impose immense costs on the global economy.

## APEC developing country impacts

Even though developing countries are not required to reduce emissions under Kyoto, they are likely to be affected by emission controls in developed countries through trade and investment linkages with countries required to reduce emissions. Trade in energy and energy-intensive products will be affected, as will foreign investment in energy production.

If significant volumes of permit trading are achieved (through one of the flexibility mechanisms proposed by the Kyoto Protocol) this could also affect developing countries. The key issues for consideration are:

- which countries will be affected and in which ways;
- the possibility that investment in energy generation will seek out environments not restricted by Kyoto targets (sometimes called "leakage");
- the effects on trade of energy-related commodities; and
- the effects on production and trade in energy intensive goods.

A number of groups have attempted to model the impact of the Kyoto Protocol on developing countries. These have included the Massachusetts Institute of Technology's Program on the Science and Policy of Global Change,[xiv] the Australian Bureau of Agricultural and Resource Economics,[xv] and Charles River Associates, a business consultancy, in association with Colorado University.[xvi]

These models generally produce results which assume targets under the Kyoto Protocol will be met. Some of the models assume trading in emission permits as permitted under the Kyoto Protocol, however the studies we examine below estimate the effects of emission reductions on developing countries in the

5 Importantly, "business as usual" emissions do include increases in efficiency of energy usage and switching towards low-$CO_2$ fuels (Lomborg, 2001: 304), but still economic growth means increased emission reductions in the absence of large scale substitutes for fossil fuels.

**Table 1. Main macroeconomic impacts of the Kyoto Protocol as modelled in selected studies[xvii]**

| Countries required to reduce emissions | Countries not reducing emissions |
|---|---|
| Increase in the cost of energy | Decrease in the cost of energy |
| Decrease in energy use | Increase in the use of energy |
| Increase in the cost of energy-intensive goods (decrease in the cost of energy intensive imports coming from non-emission reducing countries) | Decrease in the cost of energy-intensive goods in non-Annex B countries (increase in the cost of energy intensive imports from emission reducing countries) |
| Decrease in the export of energy-intensive goods | Increase in the export of energy-intensive goods |
| Decrease in investment flows | Increase in investment flows due to increased competitiveness |

**Table 2. Effects of the Kyoto Protocol on selected APEC economies, as modelled against a 'business as usual without Kyoto scenario, from selected texts[xviii]**

| | | Effects | |
|---|---|---|---|
| **Country** | **Growth** | **Terms of Trade** | **Investment** |
| China | Ambiguous | Negative | Positive |
| ASEAN | Negative (small) | Negative (small) | Positive |
| Korea | Positive | Positive | Positive |
| Taiwan | Positive (small) | Positive | Positive |
| Mexico | Negative | Negative (small) | Positive |

absence of trading. It is our assessment that the chance of significant volumes of tradeable permits by developing countries is slim. This is covered in more depth in Section 6.

## Macroeconomic impacts

The main macroeconomic impacts described in the literature are represented in Table 1, both for industrialised and developing country parties to the Kyoto Protocol.

Impacts on the APEC developing economies by country and region are set out in Table 2. When the impacts recorded by the models produce an average below 0.1 percent from the "business as usual scenarios", this is noted as "small."

The two economies most adversely affected are Mexico and China. Non-Annex B countries that are most adversely affected are large energy exporters. Apart from Mexico, none of the countries cited by the studies fall into that category (except for a couple of ASEAN countries). All the selected economies stand to benefit from increased investment.

In summary, developing countries at large would suffer the negative effects of any slowdown in global growth caused by implementing the Kyoto Protocol. Most APEC developing economies gain relatively in the short term because energy costs are relatively lower than among parties required to reduce emissions. These models only attempt to measure the economic effects of the period from 2008 to 2012. They cannot measure what happens after that period; or other scenarios, such as developing countries adopting targets.[6]

6 It is commonly argued that settling on post-2012 arrangements is central to removing uncertainty about the outcome of the Kyoto Protocol. In the absence of commitments post-2012, governments and firms are unlikely to spend as much time putting into place the complex institutional framework required for an international trade in emission permits or for the Clean Development Mechanism, since the entire framework may very well become obsolete as early as 2012.

# 4. Have APEC developing economies benefited from technology transfer and technical assistance?

The most tangible activity under the current international regime on climate change has been the programs of the Global Environment Facility (GEF) to assist developing countries to reduce emissions of greenhouse gases (GHG). GEF climate change projects to facilitate technology transfer and provide technical assistance target a number of countries in the APEC region. But do the projects provide real benefits for APEC economies and reduce reliance on fossil fuels?

## Provisions in the UNFCCC and the Kyoto Protocol for technology transfer and assistance

The United Nations Framework Convention on Climate Change (FCCC) commits developed country parties to provide financial assistance, including the transfer of environmentally sound technologies to enable developing countries to reduce greenhouse gas emissions.[xix] These commitments are reiterated in the Kyoto Protocol.[xx]

Article 11 of the Convention creates a financial mechanism to enable financial assistance and technology transfer.[xxi] The Kyoto Protocol affirmed that the financial mechanism would provide financial resources to meet the agreed, full costs for developing countries to meet their commitments under the FCCC.[xxii]

The financial mechanism is operated by the World Bank, through its Global Environment Facility.[xxiii] Developed countries are also invited under the terms of the Convention to provide financial resources through bilateral, regional or multilateral channels.[xxiv]

## Assistance provided to developing countries

The GEF provides grants to developing countries for climate change projects. The GEF receives guidance from the Kyoto Protocol Conference of the Parties (COP) on policy, program priorities and eligibility criteria. The GEF has been facilitating projects to meet climate change objectives since 1991. Between 1991 and April 2004, $1.63 billion has been allocated to climate change programs.[7] Of the 207 projects undertaken on climate change, only 43 have been completed to date.[xxv]

In 2002, in its role as the financial arm of the FCCC, the GEF allocated $127.07 million to climate change projects. With additional funding provided from other sources, the total value of projects was $951.34 million. This is a small amount compared to state aid from developed economies: official development finance from OECD member economies in 2002 was $62.7 billion.[xxvi]

In 2003 (after attracting other funding) the GEF allocated $171.66 million to climate change projects. The total value of the projects was $1.08 billion. The largest projects allocated from GEF fund were a regional project developing geothermal resources in Europe and Central Asia ($25.7 million) and a large-scale renewable energy development project in Mexico ($25.35 million). Nineteen of the 23 projects had funding allocations under $10 million.[xxvii]

GEF climate change programs are organized into four operational areas:

- Removing barriers to energy efficiency and energy conservation;
- Promoting the adoption of renewable energy by removing barriers and reducing implementation costs;
- Reducing the long-term costs of low greenhouse gas emitting technologies; and
- Supporting the development of sustainable transport.

As shown in Figure 1, on page 12 between 1991 and 2003, 53 per cent of GEF's total investment was for renewable energy projects and 27 per cent was for energy efficiency projects.[xxiii] The operational area for sustainable transport was only established in 2001 and the operational area for reducing greenhouse gases does not yet have sizable long-term programs.

The majority of projects aim for electrification through renewable energy or promote energy efficient products or markets. There has been relatively little focus on achieving efficiency in current use of fossil fuels and future development of, and reliance on coal, oil and gas.

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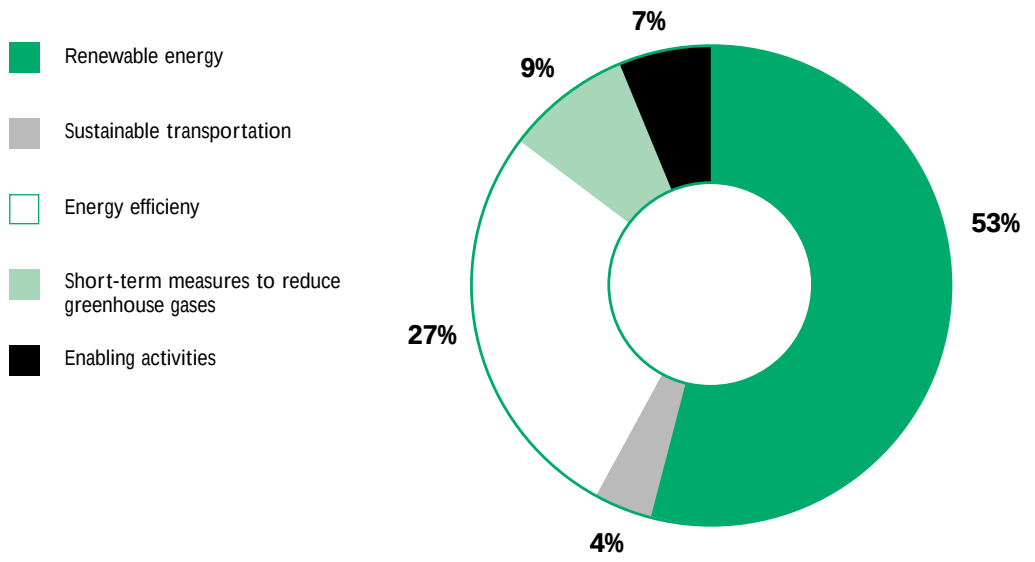
7 The total value of individual projects is higher than the GEF investment which forms only part of the project funding.

**Figure 1. GEF climate change investments, 1991 – 2003 ($ millions)**




Source: GEF (2003).

## Outcomes

The value of GEF funding on climate change projects is relatively insignificant. Despite being structured in such a way as to combine GEF allocations with investments by other organisations, the size and scope of projects are not adequate to meet the aims of the financial mechanism. Evaluating the impact of GEF projects is similarly problematic.

A review of the GEF climate change program in November 2004 found that for the 27 closed projects in the 13 years since 1991, the estimated avoided direct and indirect emissions amount to 224 million metric tons carbon dioxide at an incremental cost of US$194 million.[xxix] This is a modest result given that annual global emissions of energy-related carbon dioxide are predicted to reach 38 billion tons by 2030, with China accounting for 6.7 billion tons per year.[xxx]

According to the 2004 review, "individual projects may be responsible for high achievements in GHG avoidance, but have little potential for replication or sustained barrier removal."[xxxi] The review found that the GEF had been satisfactory in fulfilling its role but that program focus and allocations have not been maximized and have not fully addressed "the major climate change needs, even in countries with considerable potential for benefits."[xxxii]

The greatest progress in terms of outcomes to date has been made in the energy efficiency portfolio. The GEF aims for strategies to remove barriers to replication of energy efficiency measures across sectors. Achievements are promotion of energy-efficient appliances and products in Mexico and Poland and industrial boiler conversion in China. Renewable energies remain more expensive and less accessible than traditional energy sources. The GEF has concentrated on promoting the increased use of photovoltaic (PV) technology with some small successes in clinics and schools. However, PV technology remains an unaffordable and inefficient option for the market at large in developing countries.

The GEF has made some progress in individual projects focusing on renewable energy and energy-efficient products. However, these projects are generally minimal in scope and impact. The PV technology and other renewable energy projects provide tangible benefits in countries where mainstream power systems and power grids are undeveloped or in areas without access to a power grid. There have been no major gains in improving efficiencies in use in major energy consuming countries. There is still very little evidence that the GEF programs are effective in the long term in reducing greenhouse gas emissions and facilitating adaptation in developing countries.

## Assistance provided to APEC economies

APEC includes major energy producers and consumers such as China, Mexico and Indonesia. The GEF has allocated a total of $583.54 million in climate change programs in APEC economies since 1991.[xxxiii] There have also been a number of global and regional projects. By 30 April 2004, eleven projects had been completed. Details of assistance received by APEC developing economies is set out in Annex 1.

The amount of money allocated to APEC economies (and by the GEF generally) over this time is small. The largest recipients in monetary terms are China and Mexico, with $292.92 million and $116.78 million in GEF investments respectively. Indonesia, which is a major energy consumer and the world's largest exporter of liquefied natural gas (LNG) and third largest exporter of hard coal, has only received $27.41 million in investments, with two projects since 1991.

The GEF appears to being making inroads into increasing domestic capacity for renewable energy in APEC developing economies (from a very low base) but the cost and market opportunities for such technologies remain major barriers to increasing reliance on such technologies and reducing greenhouse gas emissions. There does not appear to be a strategy in place to focus on more efficient combustion of fossil fuel as a source of energy.

The challenge for the GEF climate change program is to focus projects where energy consumption is greatest and respond accordingly to improve energy use efficiency, environmentally sound technologies and renewable energy alternatives. However, programs appear to have been concentrated in areas where power consumption and distribution are problematic.[8]

8 Such an approach could produce strategic economic benefits where greater energy capacity is required for economic growth.

# 5. Does the Clean Development Mechanism offer benefits to developing economies?

The Clean Development Mechanism (CDM) is one of the "flexibility mechanisms" of the Kyoto Protocol. The mechanisms comprise provisions placed in the Protocol to reduce the cost of meeting emission targets. The CDM is designed to enable investors (governments, companies, funds) in countries with emission targets to invest in projects to reduce emissions in developing country members of Kyoto (who do not have emission targets). Each CDM project must reduce emissions beyond what would have been the case in the absence of the project. By carrying out projects that are approved through a process outlined in the Protocol, investors can generate "credits" under the Protocol which can be used to meet reduction commitments in their own country, or sold to another party to use.

The idea was that the "credits" generated by the project could be sold to others. CDM projects were intended to promote commercially sound measures enabling developing countries to participate in global efforts to abate human greenhouse gas emissions and to acquire benefits.

An alternative to foreign investment in the CDM is for entities in developing countries to engage in a CDM unilaterally (i.e. without investors from other countries). This is called "unilateral CDM". The entities carry out the project and receive the credits which they would then sell to other parties to help the other parties meet their commitments.

The CDM is designed to achieve a range of goals, not only the reduction of emissions but also social and economic development. It is intended that the permits created by a successful CDM will carry market value as permits to emit "greenhouse gases." This would depend on the existence of a single price for CDM units created in all countries and for these units to be fully fungible.

Under Kyoto, a central "CDM Executive"[xxxiv] is to be created to ensure that the CDM performs as intended. Equally, host governments must be satisfied that the project meets development goals as well as goals to reduce greenhouse gases. Understandably, for a mechanism designed to do many things in many different environments, the functioning of the CDM is fraught with complexity. While the mechanism intends to harness market power, its structure is more akin to government development assistance.

As a result of this complexity, the impacts of the CDM are uncertain. Important doubts were raised in the literature about whether the CDM could deliver anything more than a limited number of development assistance projects. These doubts were raised at the time Kyoto was negotiated in 2001[xxxv] – when the rules for the mechanism were laid down – and have been raised since.[9]

The Environment Directorate at the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) produced a joint paper in June 2004 entitled *Taking stock of progress under the Clean Development Mechanism* (OECD/IEA, 2004). The OECD report finds a reasonable estimate of the value of funds likely to be directed to CDM annually at around US$1 billion, two thirds of which has been spent on climate change investments in the World Bank's Global Environment Fund since inception. This represents around 0.15 percent of the required investment in energy infrastructure in developing countries in the 2001-2030 timeframe.[xxxvi] The paper reports that as of June 2004 no CDM projects had been registered. Further, the report found in July 2004 that "the contribution that the CDM is expected to make to emission reductions in the first Kyoto commitment period is likely to be small."

What stands in the way of large volumes of foreign investment flowing to developing countries on the back of the CDM? The problems with the CDM from an investor's point of view, either public or private, all fall broadly under the heading of risk. Some of these risks may decrease as time passes, but some of them are inherent in the structure of the CDM and the Kyoto Protocol.

9 See for example Michaelowa and Jotzo (2002): *"The prospect for large scale emission reductions in developing countries through CDM projects appear slim in the medium term."* See also Varilek & Cohen (2002); Blanchard *et al.* (2002); and Schneider and Wagner (2002).

## Hindrances to the CDM – at the level of the mechanism

Each CDM project must receive approval by a CDM Executive Board. This increases the risk of the CDM projects. The Board is under direction from the Parties, so in theory all members of the Kyoto Protocol could contribute to determining the validity of the project, increasing the risk of contradictory opinions and unfavourable outcomes.[10]

The Board represents a point of centralised control over the CDM project. It not only grants approval but also must come to hold a substantive opinion on the scientific and practical validity of the activity. It should set a baseline to establish what would have happened in the absence of the project and ensuring that it represents additional reductions from business as usual.[xxxvii]

Decisions of the Board can be changed at any time, thereby altering or eliminating the value of the credits created. Deciding how to ascertain that a project was additional to business-as-usual has proven contentious and difficult (OECD/IEA, 2004: 27). In this way the Board exercises an influence over each activity that is closer to that of a manager than that of a regulator.

Unlike the work of the CDM Executive Board, the host government does not approve projects on scientific grounds, but on subjective grounds, depending on national development goals. While the host country government has an interest in promoting investment, it also has an interest in only welcoming projects that meet its development objectives. Host governments have more influence in a CDM investment than in a normal investment and, as a result, investors in CDM projects will be subject to a much wider range of requirements than normal investors. This increases risks that investment will not or will cease to meet its financial goals. In reality few of the projects currently in the pipeline to be registered meet the twin goals of reducing emissions and generating a significant return on investment. The OECD/IEA (2004) reports:

> *A large and rapidly growing portion of the CDM project portfolio has few direct environmental, economic, social effects other than GHG mitigation, and produces few outputs other than emissions credits.*

It seems unlikely that many of the projects will be able to fit the mould of the CDM.

The attraction of the "unilateral CDM" model for developing countries is low. Developing country governments or private entities must put up all the funding required for investing in the project, the project must meet a range of diverse goals unlike a strictly commercial project and the credits produced by the project will remain of uncertain value.

## Hindrances to the CDM – at the level of the Kyoto Protocol

The primary hindrance to the CDM is uncertainty. The uncertainty about whether or not the Protocol would come in to force is now removed. A more important uncertainty surrounds the long term value of the credits created by the CDM. With the CDM process presenting a very long lead time, it is important to know what will become of the schemes proposed by the Protocol beyond 2012. Yet negotiations on that topic have not progressed. In this framework current investors in CDM projects cannot have a clear signal on the need for (or value of) GHG credits post-2012.

## The impact of the CDM on developing countries

Whatever the benefits of the CDM, its benefits for developing countries in Kyoto's first commitment period look likely to be small. The operation of the CDM provides significant risks and uncertainties. It looks unlikely that projects can achieve all their goals: reducing emissions, providing enough return to perpetuate investment and serving social and economic development goals. Either the CDM will have to change in form, or developing country hosts will have to compromise on the structure they negotiated. Long term uncertainty about the suitable role of developing countries in the Kyoto Protocol after the first commitment period continues to hinder involvement of developing country parties.

10 The COP named 10 members and 10 alternates to the CDM Executive Board.

# 6. Can developing economies gain from emissions trading under Kyoto?

The Kyoto Protocol provides for international trading in permits to emit carbon dioxide. The presumption of many analysts and a number of parties to the Protocol is that the cost of capping emissions is only reasonably affordable if global trading in emissions occurs. Some analyses envisage participation in global trading by developing countries.

"Emissions trading" is when a country required to reduce emissions under the Protocol reduces emissions beyond its target and sells the "surplus" to another country, as permits, to help the second country meet its commitments. The idea is that the countries more efficient at reducing emissions (for example developing countries with low levels of emissions) carry out more reductions than countries less efficient at doing so.

In order for developing countries to participate in the trading regime it is logical they would adopt national emission limitations. Only by reducing emission in excess of requirements can a "surplus" be created. To date however, the overwhelming majority of developing countries refuse to accept mandatory caps on emissions. German academic Axel Michaelowa (2004: 99) points out that developing countries would have no interest in developing voluntary targets if they were to become mandatory when the countries decided to trade.[11]

Doubts surround the functioning of an international trading system. The market remains fragmented, characterized by major differences between national markets and high transaction costs (Rosenzweig *et al.*, 2002). A trading system in one Kyoto member country is not equivalent to a trading system internationally. How will the relative value of commitments be measured?

If permits created in one economy are purchased by another, what happens if stringency in the first party changes, as a result of changes in government policy or softening on commitments to meet emission targets? Will the value of all credits earned in that jurisdiction rise or fall, like a currency? Or will the permits created before the change maintain their value, measured against an objective yardstick of equivalent action? Who will control measurement of these values?

Domestic allocation and enforcement systems will also complicate multilateral recognition of units. For example, take a system where permits are allocated to private entities (say, energy companies) which are then required to limit emissions. If a penalty rate is set for entities failing to meet their target, this is like a cap on price of permits to emit (when paying the penalty obviates the need to reduce emissions or purchase permits). If the price is capped at one price in one market and at another in second market, and the penalty (price cap) falls in the first, must the equivalency of two types of permits be re-negotiated, as the validity of permits in the eyes of officials in the second market falls? Or ought the value of permits in the second market to increase, as a result of increased demand?

Moral hazard will tend to encourage governments to recognize permits if meeting targets becomes difficult. Unlike currency – which is measured against goods and services – a permit's value is supported by a government's recognition of the right to pollute that is attached to it, something which is infinite in a government's own jurisdiction.

These questions highlight the need for complex global institutions to regulate and control the issuing and trading of permits. Setting up these institutions would involve constant supervision of allocation and equivalency in each bilateral "emissions trading" relationship. Setting up these institutions would take time and effort. Most players only consider this worthwhile if the system is going to be long-lived and regulatory regimes are likely to come in to harmony over the long term. For several reasons, covered above, Kyoto does not currently provide this certainty.

Some academic analysts, but not all, argue that attempts to create a global emissions trading system for profit from the Kyoto

11 Instead, he concludes that of the flexibility mechanisms only the CDM holds no immediate institutional disincentive for developing country participation (although there exist many obstacles to its operation, as outlined in Section 5, above) (Michaelowa, 2004: 99).

Protocol will fail (McKibbin & Wilcoxen, 2002; Evans, 2002; Babiker *et al.*, 2002). Others, who have carried out studies of current trading systems, believe that the potential for a large market already exists (Rosenzwieg *et al.*, 2002: 7). Some countries have already experimented with domestic systems, but none have yet tackled the problem of institutional arrangements for cross-border trade.[12] Babiker *et al.*, on the MIT program on climate change, are among the academics who remain skeptical of the prospects for robust trading beyond national boundaries; they write:

> *"The available economic studies have not been particularly helpful in their representation of these trading options. Most analysis has focused on the efficiency of an international trading system given an allocation of permits. While the analysis might be technically correct, these flows were not likely to prove politically sustainable, particularly when a substantial portion of the funds would be paying for hot air. The idea that governments will allocate permits in such a way that their citizens must first send abroad large amounts of money to get them back as permits is most generously viewed as unrealistic."*

Permits represent the opportunity to pollute up to a given amount when pollution is limited. The value of the credit is the driving force of the flexibility mechanisms. This value relies on the need to reduce emissions. If the obligations to reduce emissions are easy to meet or are not enforced, the value of credits will remain indeterminate and will approach zero. If the system is successfully regulated in all competing countries, while *at the same time* not being overly weighed down by centralised control, then trading might emerge. Cap and trade systems only function with commitments and compliance among all cooperating parties.

Increasingly it appears that the theoretical benefits of trading under a cap in a single regulatory jurisdiction do not apply to a series of caps linked under multiple regulatory jurisdictions. The long term prospects for the Kyoto Protocol are unknown. In light of this uncertainty, parties are reluctant to invest large sums in building institutions for permit trading. The European Union can operate an internal system through its administrative framework. However, existing national and sub-national schemes are yet to define institutions that could regulate permit trading beyond borders. As a result, trading among systems is so far of only nominal value.

For developing APEC economies to benefit from emissions trading an international system will have to be in place and developing countries will most likely first accept to record and cap absolute emissions and trade within the cap (OECD, 2004c: 11-13). This, in turn, must have adverse impacts on growth and development.

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12 The OECD (2004c) reports that, while domestic emission trading systems are under discussion in a number of countries, two countries – Denmark and the United Kingdom – have been implementing their own emission trading schemes, in addition to the European Union's scheme. In Denmark a small non-compliance penalty was negotiated as a result of political compromise, the penalty removing any further liability for non-compliance and thereby capping prices for emissions at a price considered fairly low. The OECD (2004c: 14) finds that the reason for the low price cap in Denmark is "current lack of symmetry in the regulation of the energy sector in neighbouring countries." In the United Kingdom the system operates on a voluntary basis, with absolute and rate-based targets co-existing. Both BP and Royal Dutch Shell have designed internal trading schemes that are limited to their internal operations and which were designed "to better understand the mechanics of trading" (OECD 2004c: 17). These schemes have no real relationship to a global scheme supported by government regulation of emissions.

# 7. Can renewable energy meet East Asia's energy demands?

## Asia's dependence on fossil fuel

Studies suggest that renewable energy is unlikely to increase its proportional contribution to the energy mix in transitional APEC economies by 2020 and only very marginally by 2030. In developing Asia the share of coal in the total primary energy supply was 52 per cent in 1997, the highest of any region in the world. This was followed by oil at 35.4 percent and gas at 8.2 per cent.[13]

The IEA predicted in 2000 that in 2020 in developing Asia the overall dependency on fossil fuel will only be slightly reduced from its level in 1997 of 95.5 percent to 94.3 percent. The IEA predicted that the demand structure will remain basically the same as in 1997, but with reduced shares of coal (43.3 percent), an increased share of gas (13.8 percent) and of oil (37.2 percent).[xxxiii]

In 2004 the IEA plotted world renewable energy consumption by economy in 2002 and predicted world renewable energy consumption by economy in 2030.

The graph below (Figure 2) shows that the most widely-used renewable energy source in 2002 was traditional biomass fuels in poor village societies. This use is not generally considered to be sustainable and will decrease with urbanization and development. In 2002 renewable energy was least important in transitional economies. The graph below (Figure 3) shows IEA predictions for renewable energy consumption in 2030. The graph shows that renewable energy use will have grown the least in the fastest growing, transitional economies, such as those of Asia.

## Energy consumption and supply in APEC developing economies

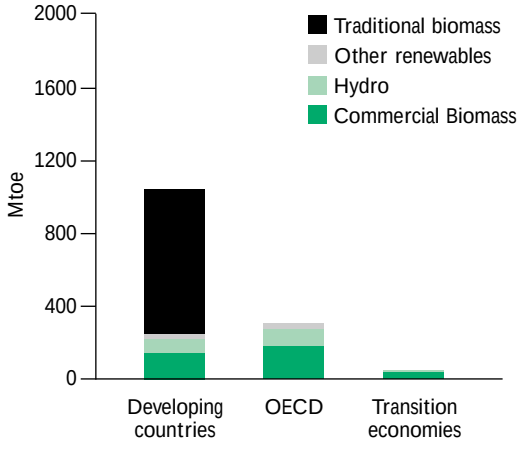
A profile of energy consumption and supply in selected APEC developing economies reveals a heavy reliance on fossil fuels, particularly oil and coal. The APEC countries analysed include large energy consumers such as China, which consumed 568,961 ktoe in 2001 and small consumers such as Vietnam, which consumed 13,017 ktoe in 2001.

Figure 4 shows that the developing countries in APEC have a high dependence on oil for final energy consumption. An exception is China, which is the world's second largest consumer of coal. Coal makes up 42 percent of total final energy consumption in China. Coal and gas are also used in the production of electricity. All economies are heavily reliant on carbon-producing fuels for energy for industry, transport and the domestic market.

Figure 5 (page 20) shows that, on average for the economies surveyed, coal, oil and gas

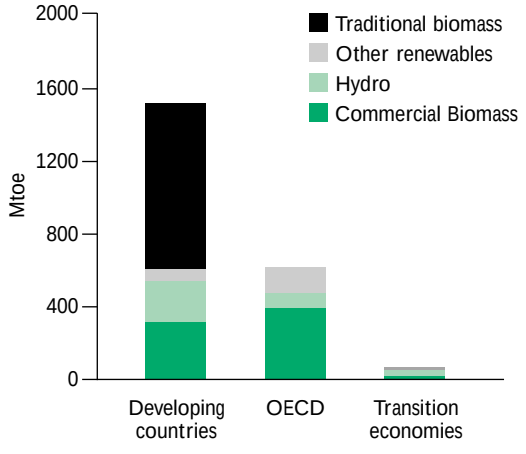
13 A paper entitled "Sustainable energy development: a challenge for Asia and the Pacific region in the 21st century" from the UN Economic and Social Commission for Asia and the Pacific (Saha, 2003: 1053), analyses data from the International Energy Agency (IEA, 2000).

**Figure 2. World Renewable Energy Consumption by economy, 2002**



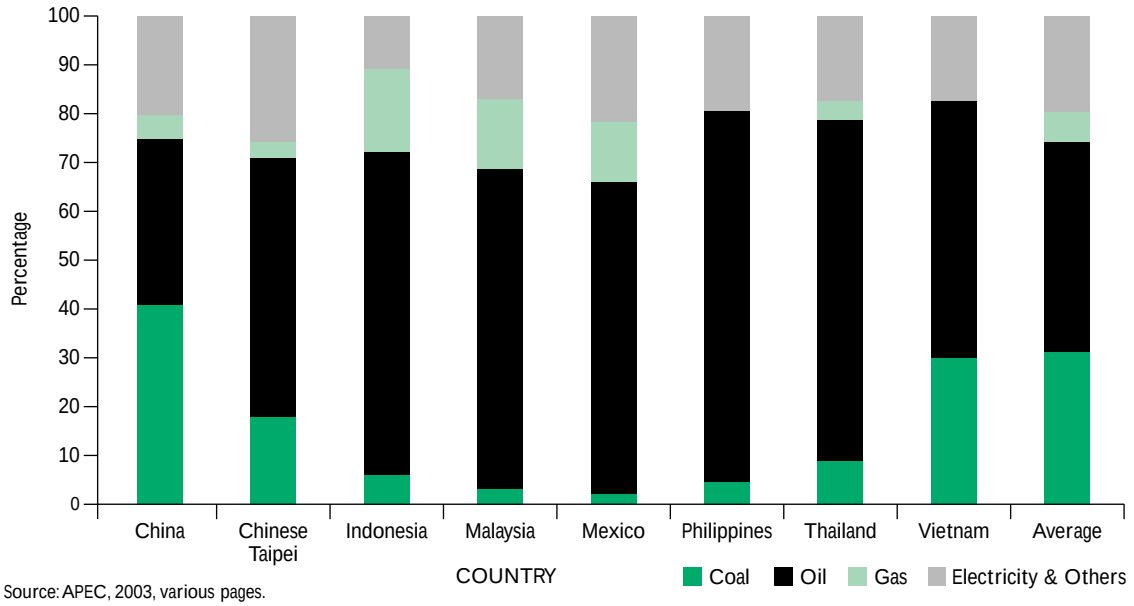

Source: IEA, 2004: 227.

**Figure 3. World Renewable Energy Consumption by economy, 2030**




Source: IEA, 2004: 227.

**Figure 4. Profile of energy consumption in APEC developing economies by country, 2001**




Source: APEC, 2003, various pages.

account for 94 percent of primary energy supply. For China, Malaysia and Thailand, fossil fuel dependence is nearly 100 percent. The Philippines, which has substantial geothermal resources is the only economy with alternative forms of energy making up more than 12 percent of total primary energy supply.

China, Indonesia and Mexico have high levels of domestic energy production (see Table 3). China is the world's third largest energy producer. In 2001, primary supply amounted to 790,018 ktoe, most being met by domestic production. China was the largest producer of coal in the world with 114.5 Gt (recoverable) of coal reserves. China was also the world's fifth largest producer of oil, but still needed to import oil and coal to meet domestic consumption. It is now the world's largest consumer of oil.

Indonesia also has considerable natural energy resources including 5,370 Mt of coal and 2,620 BCM of gas. Energy resources are important for meeting domestic consumption and providing export revenue. Oil provides 52 per cent of domestic primary supply, which is supplemented by imports.

Malaysia meets 58 per cent of its primary energy supply through gas. Gas is used for 77 percent of electricity production, with hydro providing the remainder. Malaysia also has substantial coal reserves of 1,483 Gt.

Chinese Taipei, the Philippines and Thailand are energy importers with over 50

**Table 3. Source of primary energy supply in APEC developing economies**

| Country | Domestic production (ktoe) | Imports (ktoe) | Total primary supply (ktoe) |
|---|---|---|---|
| China | 763,120 | 26,89 | 790,018 |
| Chinese Taipei | 10,751 | 73,815 | 84,566 |
| Indonesia | 168,460 | -74,247 | 94,213 |
| Malaysia | 87,486 | -25,891 | 61,595 |
| Mexico | 231,283 | -79,732 | 151,551 |
| Philippines | 13,196 | 19,530 | 32,727 |
| Thailand | 28,926 | 38,109 | 67,035 |
| Vietnam | 27,759 | -11,322 | 16,437 |

Source: APEC, 2003, various pages.

**Table 4. Primary energy demand in China (Mtoe)**

| | 1971 | 2002 | 2010 | 2030 | 2002-2030 |
|---|---|---|---|---|---|
| Coal | 192 | 713 | 904 | 1,354 | 2.3% |
| Oil | 43 | 247 | 375 | 636 | 3.4% |
| Gas | 3 | 36 | 59 | 158 | 5.4% |
| Nuclear | 0 | 7 | 21 | 73 | 9.0% |
| Hydro | 3 | 25 | 33 | 63 | 3.4% |
| Biomass and waste | 164 | 216 | 227 | 236 | 0.3% |
| Other renewables | 0 | 0 | 5 | 20 | 0.0% |
| Total | 405 | 1,242 | 1,622 | 2,539 | 2.6% |

Source: IEA, 2004, p. 264.

percent of energy needs being met through imports, primarily oil. Indeed, 92 percent of Thailand's oil requirements were met through imports in 2001.

The Philippines' energy consumption per capita is 0.2 toe, one of the lowest in the region, but it is a growing consumer. It is primarily reliant on oil and geothermal resources.

Vietnam has low levels of energy consumption. It exports energy at present. However, per capita GDP was only US$1,965 in 2001 and energy requirements can be expected to increase as the economy grows. Oil provided 56.8% of primary energy supply in Vietnam in 2001. Vietnam is a net energy exporter and is developing further capacity for gas and coal.

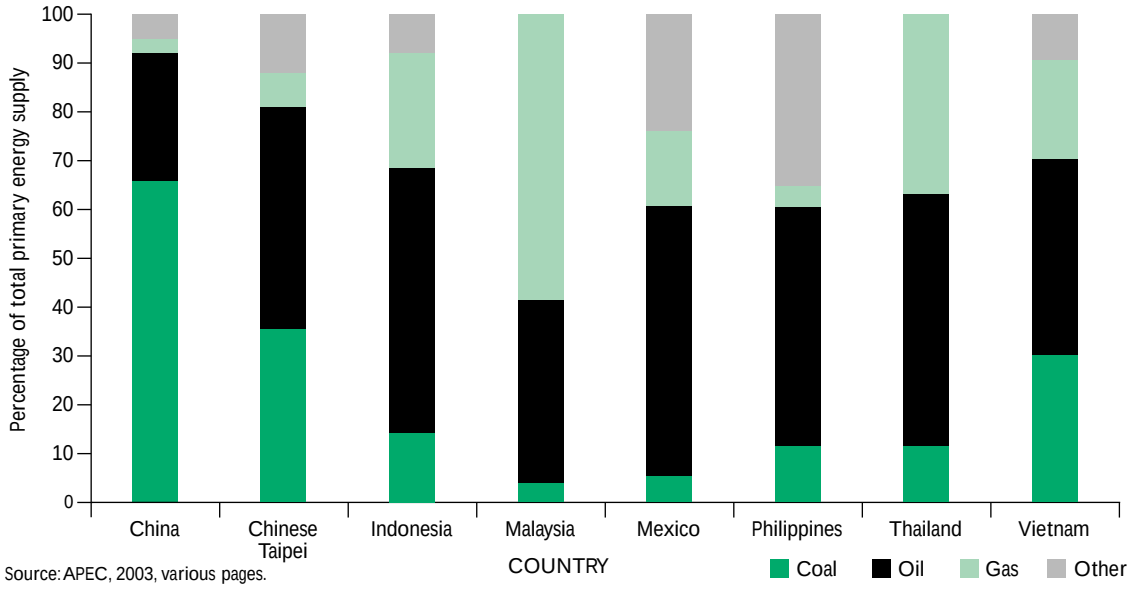
## Outlook

According to the 2004 IEA *World energy outlook* (IEA, 2004) developing countries in Asia will contribute up to 80 per cent of world incremental coal demand and 21 per cent for gas between now and 2030.[14] Energy demand growth is predicted to outpace development of domestic energy supply.

Table 4 shows that China's total primary energy demand is predicted to expand by 2.6 per cent annually between 2002 and 2030. The IEA suggests that coal will remain the dominant source of primary energy, accounting for 53

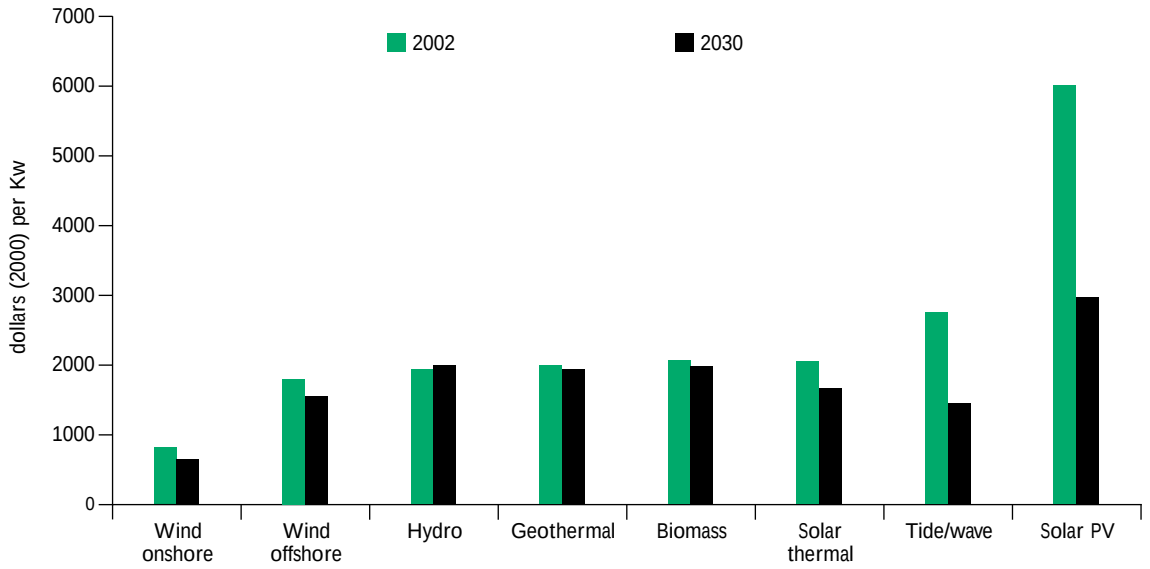
14 IEA, 2004, p. 262.

**Figure 5. Profile of total energy supply in APEC developing economies, 2001**




Source: APEC, 2003, various pages.

**Figure 6. Capital costs of renewable energy technologies, 2002 and 2030**




Source: IEA, 2004: 262.

per cent of energy supply in 2030. Increases in oil consumption and gas will be driven by transport and electricity demand, respectively.

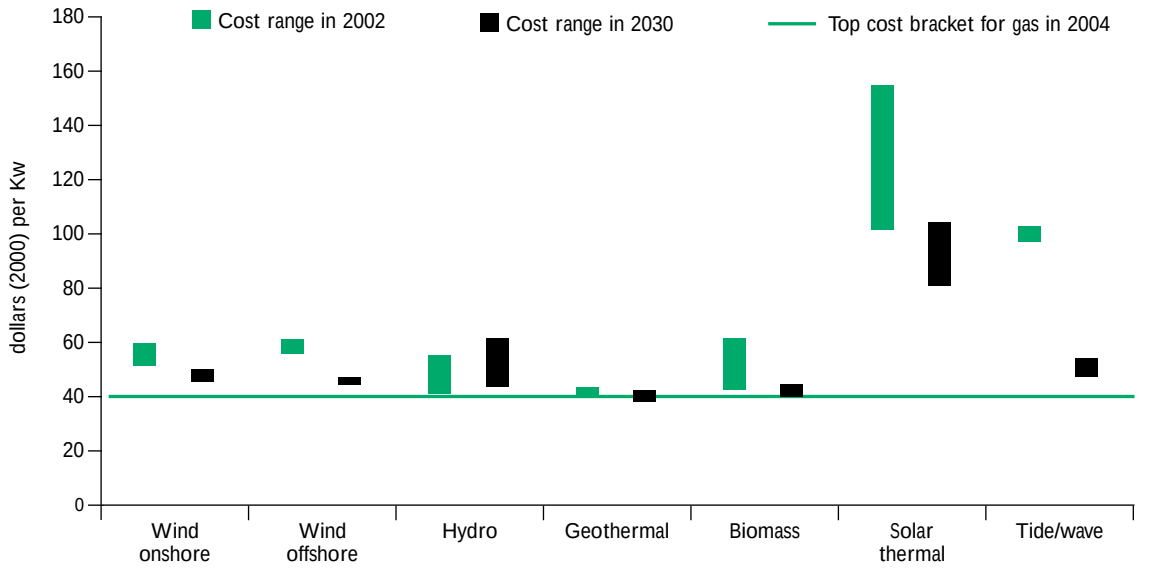
Indonesia is also predicted to experience growth in demand, at a rate of 2.7 per cent annually between 2002 and 2030. The IEA states that oil will continue to be the primary energy source but that demand for coal will grow most strongly at 4.6 per cent annually, driven by demand for power generation.

## Cost of renewables

The capital costs of renewable energy are predicted to decrease over the next 30 years. IEA predictions of these changes in cost are illustrated above (Figure 6).

According to the above estimates, only four alternative power sources illustrated in Figure 6 are likely to decrease significantly in capital cost within the next 30 years: these are wind, solar (thermal/photovoltaic and PV) and tide energy. Figure 7, below, shows ranges of

**Figure 7. Electricity-generating costs of renewable energy technologies, 2002 and 2030**




Source: IEA 2004: 233-6.

generating costs for these energy alternatives for 2002 and 2030. The generating costs of renewables will decline generally as a result of falling capital costs.

Of the above alternatives, only hydro has potential for more than a marginal application by 2030 – around 4,000 Twh (Table 5) – compared with other renewable sources, although its cost will increase as suitable sites become more scarce. Only wind (on-shore and off-shore) will decrease significantly in both capital costs and generation costs by 2030. Wind carries technical features that limit its use as a basic source of base load power. These are:

- All wind sources require back-up capacity. The near impossibility of predicting wind supply over a longer period than 36 hours means a steady supply of power is required to support wind power.
- Wind turbines are connected to the grid at low voltage, which adds cost to systems control and operation.

It is predicted wind will provide around 1,000 TWh of energy in 2030 (Table 5).

Geothermal energy and biomass were both near competitive in generating costs in 2002 (Figure 7), although it is predicted that capital costs will not fall much before 2030 (Figure 6). IEA predicts that the capacity for geothermal by 2030 to be very small, at approximately 170 TWh (Table 5). Biomass, while having a larger potential than geothermal energy, frequently contributes to the production of greenhouse gases and is not always suitable as an alternative to fossil fuels for this reason. Tide/wave energy consumption is predicted to reach 37 TWh in 2030, which is still a minuscule contribution to global energy consumption, even compared to other renewable sources (Table 5).

Solar thermal power is projected to reach only 21 TWh by 2030, produced almost exclusively in OECD countries. Electricity generation from solar photovolatics is excessively costly – between US$350 and $600 per MWh, or eight to ten times higher than the cost of conventional energy sources – and as such is not included on Figure 7. The economics of generation by solar thermal power will improve over the projection period, but it will not become cost-competitive in a large scale before 2030.

**Table 5. Forecast for world electricity generation, 2030, by energy source**

| Energy source | World |
|---|---|
| Coal | 12,500 |
| Gas | 9,500 |
| Hydro | 4,248 |
| Nuclear | 3,250 |
| Wind | 929 |
| Biomass | 350 |
| Geothermal | 167 |
| Solar | 47 |
| Tide/wave | 37 |

Source: IEA, 2004:232.

As outlined above, the consumption of these renewable energy alternatives will be restricted almost exclusively to poorer developing countries (biomass, hydro) and OECD countries (hydro, wind). Consumption in transitional economies is predicted to be miniscule.

## The limited role for renewable energy

Renewable energy (other than nuclear energy – not discussed here) has no prospect of supplanting non-renewable energy as a major source of power in Asia in the foreseeable future.

# 8. Should developing APEC economies cut emissions?

There is a wide spread belief in Europe that developing countries would eventually adopt emission targets under the Kyoto Protocol. Many believed this was implicit in the Protocol itself. Developing countries point out there is nothing in the Kyoto Protocol which indicates any such intention nor is there an obligation for non-Annex 1 countries to reduce emissions.

Approaches have been made to developing countries by representatives of the European Union, for example during the Johannesburg Summit on Sustainable Development in 2002, to consider taking on targets in the future, for example as part of the commitment parties negotiate for targets after 2012. At the time leading developing countries re-iterated their position that developing countries should not commit to reduce emissions.[15]

It is an option now for developing country parties to join Annex 1 of the Kyoto Protocol (as Argentina has) and make commitments to reduce emissions.

Should developing countries consider cutting emissions?

What would developing countries gain by doing so? This question can be considered from the global standpoint and from the standpoint of developing countries themselves.

## The global impact

It is evident that a weakness of the Kyoto Protocol is that the regime for reducing emissions of greenhouse gases is that it excludes some economies that generate significant greenhouse gas emissions. The impact of the reductions of global levels of greenhouse gas emissions to which parties to Kyoto have committed will only slightly slow down the rate of increase in global greenhouse gas concentration.

Demand for energy in developing economies is expected to increase strongly into the future, increasing the share of anthropogenically-produced greenhouse gases. Against that scenario, the capacity of the Kyoto regime in the medium to long term to secure effective reduction in concentrations of greenhouse gases in the atmosphere (and hence its capacity to counter global warming) will be reduced further.

Would participation in a Kyoto-style global program by developing countries result in effective reduction of anthropogenic greenhouse gases? (Perhaps the more important question is would that program contribute to a slowing of global warming? This paper has not sought to address that basic question here, but does note that a number of earth scientists consider it would not).[16]

Presuming that the Kyoto framework operated as intended (there any many unknowns about how certain provisions, such as global emissions trading, would work), the impact of the cuts on global $CO_2$ concentrations currently mandated in the Kyoto Protocol is predicted to be indiscernible (Wigley 1998:2,286).[17]
There is no question that if all economies capped emissions there would ultimately be some reduction in anthropogenic emission of $CO_2$. The question is by how much and at what cost.

What would be the economic impact on developing countries at large if both the United States and developing countries capped emissions? First the global economy will grow more slowly. When global growth slows, so does growth in developing countries. One of

15 At the Eighth Session of the Conference of the Parties to the UN Framework Convention on Climate Change in 2002 the then Indian Prime Minister Shri Atal Bihari Vajpayee said the following: "There have been suggestions recently that a process should commence to enhance commitments of developing countries on mitigating climate change beyond that included in the Convention. This suggestion is misplaced for several reasons." The reasons stated were developing country emissions were relatively small, per capita incomes were low and greenhouse gas "intensity" to purchasing power parity was low. He concluded "Thus, the assertion that developing countries generate GHG emissions which are unnecessary for their economies is not based on facts." Press Information Bureau, Government of India, http://pib.nic.in/archieve/lreleng/lyr2002/roct2002/30102002/r301020023.html, accessed 19/11/2004.

16 Earth scientists consider there to be overwhelming geological evidence that "natural variability in Earth's climate greatly exceeds human-induced effects" (Lamb 1995; Bluemle *et al*., 2001; Gerhard *et al*., 2001; Gerhard, 2004) and that there is no current technology to control that natural variability. These scientists point to factors such as the correlation of sun intensity cycles, orbital variations and geological elements and find that the Earth's climate is fundamentally beyond human control (Hoyt and Schatten, 1997; Bond *et al*., 2001; Davis and Bohling, 2001).

17 This uses the IPCC's IS92a scenario for growth in greenhouse gas emissions, the scenario typically used to represent "business as usual" in IPCC reports (IPCC, 1992; 2000).

the most important forms of economic support for poorer economies is growth in the world economy.

Bjørn Lomborg demonstrates a second effect. The Kyoto-style programs to abate climate change are very costly. They will be at the expense of other activities. They will reduce financial resources, such as development assistance, otherwise available to assist developing countries. He makes a general analysis of this and makes a strong case that it is more practicable to meet the cost of adapting to the impacts of climate change than to meet the costs of efforts to abate levels of greenhouse gases through measures such as those proposed in the Kyoto Protocol. Lomborg[18] puts it directly:

> *Put very simplistically, the world ends up paying for the trouble of global warming twice over – first every year from 2050 we pay 2 percent of GDP for cutting $CO_2$, and when we reach 2100 we pay 2 percent more because of higher temperatures which are almost unaffected by the Kyoto Protocol.*

The problem of Kyoto's cost is even more powerful when its limited impact is considered.

The net loss of resources would be felt most by the poorer developing countries. Wealthier developing countries will over time depend less and less on development assistance to support economic growth. What would be the direct impact on those economies if they elected to cut global emissions?

## Direct impacts

The effect of capping emissions of greenhouse gases as proposed in Kyoto is to reduce the consumption of energy. It achieves this by increasing the cost of energy from fossil fuel sources and creating a disincentive to use it. This will not redirect energy consumption in any significant way to new technologies because, as has been demonstrated in the previous chapter, no technologies are readily available which can produce energy today at a price which is competitive with fossil fuels.

The immediate impact of imposing caps on emissions is to increase power costs. That is why industrialized economies wanted global emissions trading to accompany a program of caps so the cost could be redistributed globally in a way that minimized the impacts on global growth. As noted in an earlier chapter, the prospects of global emissions trading as envisaged in the Kyoto Protocol are poor.

Increasing the cost of energy will inhibit growth in developing countries. The demand for energy among APEC developing economies has been shown in the previous chapter. If APEC developing economies imposed the sorts of caps proposed in the Kyoto Protocol, this would be at the expense of economic growth and would run counter to strategies to raise standards of living. The analysis by Russian experts of the negative impact on economic growth in Russia of accession to Kyoto demonstrates this effect in the case of Russia (Illarionov, 2004).

## Is there risk of trade retaliation?

A number of legal and economic think tanks in Europe have produced reports in recent years on the feasibility of parties to the Kyoto Protocol who had capped emissions imposing trade restriction on products from countries which had not.[19] Are developing countries at risk of trade retaliation if they do not cut emissions?

There is an increasing trend to impose trade restrictions with the purpose of requiring imported products to comply with environmental standards in the importing market. The European Union leads this practice.[20]

Some of these restrictions will not be permitted by WTO rules. Generally they do not allow discrimination among imports according to how a product is made or processed. This is one reason why NGOs like the World Wide Fund for Nature (WWF) and Greenpeace have been campaigning to "green the WTO" by calling for changing its rules so that imports

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18 Lomborg (2001: 304) uses as a guide the results of 13 models presented to the Stanford Energy Modeling Forum.

19 Centre for International Environmental Law/World Wildlife Fund (2001) *"Towards coherent environmental and economic governance legal and practical approaches to MEA-WTO linkages"*, Geneva: CIEL.

20 Australian APEC Study Centre (2003) *European unilateralism – Environmental trade barriers and the rising threat to prosperity through trade*, Monash University, Melbourne; Lawrence A Kogan (2003) *EU regulation, standardization and the precautionary principle: The art of crafting a three-dimensional trade strategy that ignores sound science*, National Foreign Trade Council Inc, Washington DC.

can be restricted unless they meet environmental standards governing methods of production and processing.

It is a goal of the EU in the Doha Round negotiations in the WTO to secure new rights to restrict trade on environmental grounds. Pascal Lamy, the EU Trade Commissioner, conceded during the meeting of WTO Ministers at Cancun, Mexico in September 2003 that the EU was isolated on this matter in the WTO. Developing countries made clear as early as 1996 at the WTO Ministerial Meeting in Singapore that they would not go along with the creation of new environmental (or labor) grounds for restricting trade.

Environmental officials in Europe and North America point to the results of some trade disputes in the WTO which have permitted its imposition of trade restrictions on the grounds that the measure supported international efforts to protect the environment. The case more frequently cited is known as the "Shrimp Turtle" dispute.[21] The extent to which this ruling might be used to apply to countries which cap emissions of greenhouse gases has been analysed extensively.[22]

Mainstream legal analysts do not consider such developments are practicable. The Kyoto Protocol explicitly excludes developing countries from obligations to cut emissions. As a party to the Protocol, the EU could not argue that developing countries were failing international obligations to abate climate change because they had not implemented the provision of that Protocol.[23] And if they did decide to consider going down that path or another like it, they would fracture the limited global consensus about taking action to address climate change that the Kyoto Protocol represents.

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21 United States – Import Prohibition of Certain Shrimp and Shrimp Products, Report of the Panel, 15 May 1998, WT/DS58/R, Report of the Appellate Body, 12 October 1998, WT/DS58/AB/R, Recourse to Article 21.5 by Malaysia. Report of the Panel, 15 June 2001, WT/DS58/RW; The US enacted a ban on the importation of certain shrimp and shrimp products that were harvested with technology that could adversely affect sea turtles. The measure was aimed at the protection of sea turtles. It was challenged by Malaysia, India, Pakistan and Thailand under the WTO disputes system. The ultimate conclusion of the proceedings was that the US was entitled to continue to apply the ban.

22 See Duncan Brack and Kevin Gray (2003) *Multilateral environmental agreements and the WTO*, Royal Institute of International Affairs and International Institute of Sustainable Development, September 2003, on how in light of Shrimp Turtle, trade measures in MEAS may be justified under WTO rules. See also Matthias Buck and Roda Verheyen (current and former researchers at Hamburg University's Research Unit Environmental Law), *International trade law and climate change – a positive way forward, FES-analyse okologische marktwirtshaft*, July 2001, noting that as a result of the shrimp turtle case, trade restrictive environmental measures can be justified under WTO rules if agreed and negotiated multilaterally.

23 Consideration of trade restrictions against countries not party to the Kyoto Protocol (particularly the US and Australia) is a separate question. Some argue the Turtle Shrimp case creates a precedent. Initiation by the EU of such action against the US would have major implication for the WTO. While the EU does attach a higher priority than anyone else to securing new grounds in the WTO so trade can be generally restricted on environmental grounds, it would fracture global efforts to advance global trade liberalization through the WTO, a broad trade goal the EU shares with the US, if Kyoto specific trade measures were initiated. The Shrimp Turtle ruling also reflected principles about when trade might be restricted that the overwhelming majority of WTO members would not accept if they were considered in the WTO's executive bodies.

# 9. Practicable approaches to addressing climate change

The Kyoto approach to reducing human greenhouse emissions mandates reduction of emissions. In the absence of alternative fuels, stabilising emissions this way imposes vast costs on the global economy, as shown in previous sections. The Kyoto approach, if carried forward with bigger targets beyond 2012, threatens great expense to global GDP, as outlined in Section 3. Section 8 shows that renewable fuels appear unlikely to provide fast-growing, transitional APEC economies opportunities to reduce emissions of greenhouse gases in the medium term without seriously sacrificing growth.

However, these problems do not mean that APEC developing economies are unable to address the consequences of human-induced climate change. Practical examples exist of ways in which private and public parties have acted to counter risk.

There are strategies fast-growing APEC economies can take to reduce emissions in the short to medium term using existing technologies. Research programs have been launched to develop new technologies to manage emissions of carbon dioxide in the longer term. Private investment is playing an important role in furthering these initiatives.

## Existing technologies

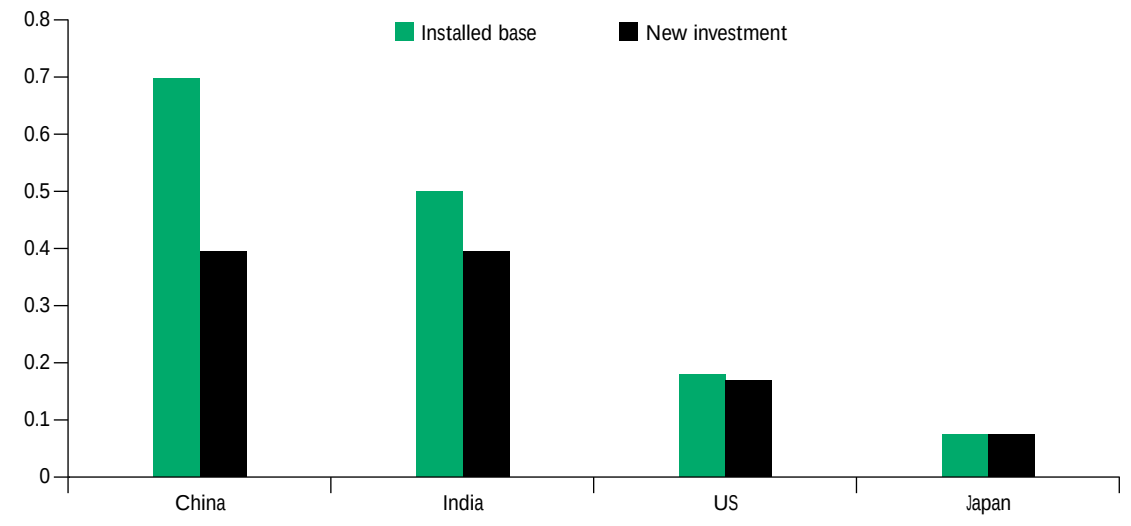
The most effective alternative renewable technology is nuclear power. Power generators in recent years have set this aside as an option. It is however a practicable option and is being reconsidered.

Increased fuel efficiency through investment in modern power equipment for generating energy from fossil fuel is the most important avenue available for reducing emissions in APEC developing economies. Figure 8 shows how emissions would reduce in China if power generating systems were replaced with modern technology in infrastructure. The potential for new infrastructure to deliver similar gains in fully industrialised markets is limited, by comparison as Figure 8 shows.

Technical innovations in fuel efficiency frequently come to developing markets through foreign direct investment. It is in those markets receiving the largest volumes of foreign direct investment that fuel efficiency is increasing most dramatically.

Research suggests that foreign direct investment is its most important channel for technology transfer in the developing world. This is the case for cutting edge, commercial technologies, including those specifically designed to target environmental problems (OECD, 2002). In contrast to the cumbersome bureaucratic risk of the CDM mechanism, transparent, rigorous and predictably-enforced regulatory regimes are far more likely to attract innovative technology, since they reduce the risk for investors in bringing an asset to a foreign market. In this way, the right regulatory

**Figure 8. Greenhouse gas emissions per dollar of output**




Source: Charles River Associates.[xxxix]

environment can encourage technological advances in efficiency, driven by growth. This path is in contrast to mandated emission targets that raise the cost of energy.

## New technologies

While efficiency will increase in fast developing economies over the coming decades, it is certain that the use of fossil fuels will continue for some time in developed and developing economies alike. The time and investments required to put in place systems that emit much less carbon will be large. One way to reduce $CO_2$ emissions from fossil fuel use during this transition is to capture and store the $CO_2$. Research is being done by a number of groups to explore opportunities for $CO_2$ capture or "sequestration".

Combustion remains the primary way in which chemical energy is made available for use by humankind. As such, advances in the way that we perform energy conversions using combustion can have a significant impact on the greenhouse gas balance of the planet. Because of its ubiquitous nature, advances in combustion technologies can provide benefits in many areas from home heating, to transportation, to electrical power generation, to industrial processing.

The Global Climate & Energy Project (GCEP) at Stanford University is an unprecedented research collaboration between the scientific and engineering community and major global companies to develop new energy technologies for the future, providing around US$250 million over ten years towards cutting edge research.[24]

Research efforts under the banner of the GCEP are examining sequestration of $CO_2$ in porous systems in the Earth's crust. Methods now used to separate $CO_2$ from other gases include solvent techniques and membrane separations. Both methods require energy input to recover $CO_2$ from the solvent. The project explores more efficient, lower-cost separation techniques that may improve the feasibility of $CO_2$ capture.

Potential storage locations include depleted oil and gas reservoirs, deep unmineable coal beds, and deep porous formations containing salt water. Oil and gas reservoirs exist only where there is an underground structure that includes a seal that can retain gas and oil, and subsequently, $CO_2$ for long periods. Considerable experience developed in enhanced oil-recovery operations will be available to guide $CO_2$ storage projects. Coal bed storage relies on absorption of the $CO_2$ on coal surfaces, while storage in deep formations containing salt water makes use of the $CO_2$'s solubility in salt water.

Studies of capacity for the storage of large quantities of $CO_2$ in the subsurface (Parsons & Keith, 1998; Gale, 2003) suggest (still with much uncertainty) that there is sufficient capacity to store a significant fraction of expected $CO_2$ emissions through 2030 and beyond.[25]

## Conclusion

Practicable approaches to tackling the risk of climate change must permit non-industrialised and fast-growing economies access to affordable energy. Growth, not stagnation, is likely to produce technological outcomes that improve standards of living and our capacity to deal with risk. Investment from high technology energy producers is a primary vehicle for technology transfer to developing markets and the most effective means for APEC developing economies to reduce emissions of $CO_2$ in the short to medium term.

The paucity in genuine, large-scale alternatives to fossil fuels, nuclear power excepted, suggests that other options must be considered for dealing with the risk of increased concentrations on $CO_2$. Research on new technologies for sequestration of $CO_2$ and combustion is a practical long term alternative.

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24 This funding, provided by four major global companies over ten years, represents around 15 percent of spending on climate change programs in the World Bank GEF since its inception in 1991.

25 The research suggests subsurface storage capacity of between 1480-6650 $GtCO_2$, although this volumetric measure does not indicate that injection can be undertaken at that scale. Nonetheless, current emissions are about 24 $GtCO_2$/yr (1 $GtCO_2$= 1 billion metric tons of $CO_2$) and according to the estimates of the International Energy Agency (IEA, 2004) are expected to rise to 38 $GtCO_2$/yr. If the rise in emission were roughly linear, then the total emissions would be about 1300 $GtCO_2$ for the period from 2000 to 2030. Thus, even given the uncertainty in the estimates, the capacity of geologic formations to store $CO_2$ appears to be sufficient to permit storage at a significant scale. In order for geologic $CO_2$ sequestration to be an effective tool in the stabilization of atmospheric $CO_2$ concentrations, a goal of sequestering about 3 Gt of carbon per year (~10 Gt $CO_2$/y) must be met by mid-century (based on current emissions predictions). Studies suggest that such capacity could be available by mid-century.

# Annex 1. Technology transfer, the GEF and assistance to APEC developing countries

The most tangible activity of the international regime on climate change has been the programs of the Global Environment Facility (GEF) to assist developing countries to reduce emissions of greenhouse gasses. By and large, these have supported introduction of new forms of renewable energy rather than encouraging greater efficiency in combustion of fossil fuels and use of energy. Most programs focus on delivery of forms of power in poor economies where energy systems are not well developed. However, programs do not focus on reducing emissions of $CO_2$ in economies which are the largest consumers of energy, such as East Asian economies.

## Provisions in the UNFCCC and the Kyoto Protocol for technology transfer and assistance

The United Nations Framework Convention on Climate Change (FCCC) commits developed country Parties to provide financial assistance, including the transfer of environmentally sound technologies to enable developing countries to meet their commitments under the Convention and to reduce anthropogenic emissions of greenhouse gases.[26] Developed countries are committed under the Convention to assist countries which are significantly vulnerable to the impact of climate change (such as small island countries), those whose economies are highly dependent on income generated from fossil fuels and least developed countries.[27] They are also obligated to meet developing countries' costs of adapting to climate change.[28]

These commitments are reiterated in the Kyoto Protocol, which promotes increasing the transfer of, and access to, environmentally sound technologies and capacity building activities.[29] The FCCC recognizes developing country implementation of commitments under the Convention will be related to the level of financial assistance and technology transfer and limited by the overriding priority of economic and social development and poverty alleviation.[30]

The provision of financial assistance and technology transfer functions through a financial mechanism as set out in Article 11 of the Convention.[31] The Kyoto Protocol affirmed that the financial mechanism provides financial resources to meet the agreed full costs for developing countries to meet their commitments under the FCCC and resources, including for the transfer of technology, needed by developing countries to advance their commitments.[32]

The financial mechanism is operated by the World Bank Global Environment Facility (GEF) with a review of the mechanism every four years.[33] Developed countries are also invited to provide financial resources under the Convention through bilateral, regional or multilateral channels.[34]

At the seventh Conference of the Parties (COP) to the FCCC frameworks for addressing capacity building and technology transfer through the financial mechanism (GEF) were adopted.[35] The framework for technology transfer aims to enhance implementation of Article 4(5) of the Convetion (as set out above) through five key areas:

- Technology needs assessments;
- Technology information – establishing an efficient information system to support technology transfer;
- Enabling environments – identifying and analyzing ways of facilitating technology transfer, including removing barriers at each stage of the process;
- Capacity building – facilitating activities to further technology transfer including improving knowledge in energy efficiency and the utilization of renewable technologies; and

26 United Nations Framework Convention on Climate Change (UNFCCC) 1992, Article 4 (3), (5).

27 UNFCCC 1992, Article 4 (8), (9).

28 UNFCCC 1992, Article 4 (4).

29 Kyoto Protocol to the UNFCCC, Article 10(c) – FCCC/CP/1997/7/Add.1.

30 UNFCCC 1992, Article 4 (7).

31 UNFCCC 1992, Article 11 (3).

32 Kyoto Protocol to the UNFCCC, Article 11 – FCCC/CP/1997/7/Add.1.

33 Decision 3/CP.4.

34 UNFCCC 1992 Article 11 (5).

35 Decisions 2, 4 and 6 /CP.7.z

- Mechanisms for technology transfer – developing actions to increase the transfer of and access to environmentally sound technologies and knowledge.[36]

Guidance to the GEF included focusing on least developed countries, small island states, countries particularly vulnerable to climate change and establishing pilot projects.[37] Funds have been set up through the financial mechanism specifically targeting least developed countries (LDC Fund) and technology transfer focusing on adaptation (Special Climate Change Fund).[38] Priority areas for assistance are: implementation of the results of technology needs assessments; technology information; capacity-building for technology transfer and enabling environments.[39] The arrangements for these funds are not yet finalized.

## Assistance provided to developing countries

The GEF provides grants to developing countries for climate change projects as the mandated financial mechanism under the FCCC. The GEF receives guidance from the COP on policy, program priorities and eligibility criteria.

The GEF has been facilitating projects to meet climate change objectives since 1991. Between 1991 and April 2004, $1.63 billion has been allocated to climate change programs.[40] This is a relatively insignificant amount of funds in development assistance terms for the period in question. In comparison, the provisional amount of official development finance (including development assistance and official aid) from OECD member economies for one year (2002) was $62.7 billion.[41] 207 projects have been undertaken in the climate change area; only 43 projects have been completed to date.[42]

In 2002, the GEF allocated $127.07 million to climate change projects, according to its role operating the FCCC financial mechanism. The total value of these projects after they attracted additional funds was $951.34 million. Most projects were either for renewable energy (42.3 percent of GEF climate change investment) or energy efficiency (40.3 per cent of GEF climate change investment).[43]

In 2003, the GEF allocated $171.66 million to climate change projects. 53 per cent of that was allocated to renewable energy projects and 33 per cent to energy efficiency projects. The total cost of the projects was $1.08 billion. Implementing agencies included the World Bank, UNDP and UNEP. The largest projects in terms of GEF funds allocations were a regional project developing geothermal resources in Europe and Central Asia ($25.7 million) and a large-scale renewable energy development project in Mexico ($25.35 million). However, 19 of the 23 projects had funding allocations under $10 million.[44]

GEF climate change programs are organized into four operational areas:

- Removing barriers to energy efficiency and energy conservation;
- Promoting the adoption of renewable energy by removing barriers and reducing implementation costs;
- Reducing the long-term costs of low greenhouse gas emitting technologies; and
- Supporting the development of sustainable transport.

Between 1991 and 2003, 53 per cent of GEF's total investment was for renewable energy projects and 27 per cent was for energy efficiency projects. Nine per cent was allocated to projects on short-term measures to reduce greenhouse gases, 7 per cent was allocated to enabling activities and 4 per cent went towards sustainable transportation.[45] The operational area for sustainable transport was only established in 2001 and the operational area for reducing greenhouse gases does not yet have sizable long-term programs.

Most of the projects aim for electrification through renewable energy or promote energy

36 Decision 4/CP.7.

37 Decision 6/CP.7.

38 Decision 27/CP.7 and Decision 6/CP.8.

39 Decision 5/CP.9.

40 The total value of individual projects is higher than the GEF investment which forms only part of the project funding.

41 OECD, Statistical annex of the 2003 Development co-operation report.

42 GEF, Program sStudy on climate change, 4 November 2004.

43 GEF Annual report 2002, p. 13.

44 GEF Annual report 2003, pp. 13, 17-18.

45 GEF Annual r4(5) of the Convention (as set out above) through five key areas: report 2002, p. 13.

efficient products or markets. There are a growing number of projects for productive uses of renewable energy, including co-generation of electricity and product development. There has been very little focus on current use of fossil fuels and future development of and reliance on coal, oil and gas.

## Assistance provided to APEC economies

APEC includes major energy producers and consumers such as China, Mexico and Indonesia. The GEF has allocated a total of $583.54 million in climate change programs in APEC economies since 1991 (see Table 7). There have also been a number of global and regional projects. By 30 April 2004, eleven projects had been completed.

The amount of money allocated to APEC economies (and by the GEF generally) over this time, is small. The largest recipients in monetary terms are China and Mexico, with $292.92 million and $116.78 million in GEF investments respectively. Indonesia, which is a major energy consumer and the world's largest exporter of liquefied natural gas and third largest exporter of hard coal, has only received $27.41 million in investments, with two projects since 1991.

Of the 23 climate change projects funded by the GEF in 2003, four were global/regional and eight were in APEC economies (see Table 6 below).

In May 2004, the GEF approved a grant to promote the increased use of photovoltaic (PV) technology in Malaysia, including the promotion of the newer building-integrated photovoltaic (BIPV) technology. The aim is to increase Malaysia's BIPV capacity by 330 per cent and reduce usage costs. Other current renewable energy projects include the development of a solar thermal plant in Mexico and a renewable energy up-scale project in China to remove barriers and reduce costs for the introduction and use of hydro, wind and selected biomass technologies.[47] The $63.51 million invested in the Philippines reflects the significant domestic geothermal potential.

The GEF appears to being making inroads into increasing domestic capacity for renewable energy in APEC developing economies (from a very low base) but the cost and market opportunities for such technologies remain major barriers to increasing reliance on such technologies and reducing greenhouse gas emissions. There does not appear to be a successful strategy in place to significantly reduce reliance on traditional fossil fuels in the future as energy consumption increases. The long-term impact may be to supplement existing power supplies – expand renewable energy markets but not the increasing use of carbon dioxide emissions from consumption of fossil fuels.

The challenge for the GEF climate change program is to focus projects where energy consumption is greatest and respond accordingly to improve energy use efficiency, environmentally sound technologies and

46 GEF *Annual report* 2003, pp. 17-18.

47 www.gefweb.org.

**Table 6. GEF climate changes projects in APEC countries, 2003[46]**

| Country | Project | GEF allocation (US$ millions) | Total cost (US$ millions) |
|---|---|---|---|
| Chile | Sustainable transport and air quality for Santiago | 7.33 | 14.77 |
| China | End use energy efficiency | 17.38 | 80.38 |
| Mexico | Action plan for removing barriers to the full-scale implementation of wind power | 4.74 | 25.35 |
| | Large-scale renewable energy development project | 11.81 | 272.85 |
| Peru | Lima urban transport | 8.28 | 134.28 |
| Philippines | Electric cooperative system loss reduction | 12.35 | 62.85 |
| Russia | Removing barriers to coal mine methane recovery and utilization | 3.30 | 8.41 |
| Vietnam | Demand-side management and energy efficiency | 5.72 | 19.44 |

**Table 7. GEF projects in APEC developing economies (1991 to April 30, 2004)**

| Country | Project name | Agency | Year approved | Total GEF financing (US$ millions) | Project Status |
|---|---|---|---|---|---|
| **Chile** | Reduction of greenhouse gases | UNDP | 1993 | 1.70 | A |
| | Removal of barriers to rural electrification | UNDP | 2001 | 6.07 | A |
| | Sustainable transport and air quality for Santiago | WB | 2003 | 7.33 | F |
| | | | | **15.10** | |
| **China** | Development of coalbed methane resources in China | UNDP | 1991 | 10.00 | C |
| | Issues and options in greenhouse gas emissions control | UNDP | 1992 | 2.00 | C |
| | Sichuan gas transmission and distribution rehabilitation | WB/UNDP | 1992 | 11.40 | C |
| | Energy conservation and pollution control in township and village enterprises | UNDP | 1995 | 1.00 | C |
| | Efficient industrial boilers | WB | 1996 | 33.56 | A |
| | Promoting methane recovery and utilization of mixed municipal waste | UNDP | 1996 | 5.31 | A |
| | Capacity building for the rapid commercialization of renewable energy | UNDP | 1997 | 8.85 | A |
| | Energy conservation | WB | 1997 | 22.35 | A |
| | Barrier removal for the widespread commercialization of energy-efficient CFC-free refrigerators | UNDP | 1998 | 9.86 | A |
| | Renewable energy development | WB | 1998 | 35.78 | A |
| | Energy conservation and GHG emission reduction in Chinese township and village enterprises, phase II | UNDP | 1999 | 8.00 | A |
| | Second Beijing environment project | WB | 2000 | 25.00 | A |
| | Barrier removal for efficient lighting products and systems | UNDP | 2001 | 8.14 | A |
| | Demonstration of fuel cell bus commercialization in China (phase II-part II) | UNDP | 2001 | 5.82 | A |
| | Passive solar heating for rural health clinics | WB | 2001 | 0.78 | A |
| | Targeted research related to climate change | UNDP | 2001 | 1.72 | A |
| | Renewable energy scale up program (CRESP), phase I | WB | 2001 | 41.57 | F |
| | Wind power development project | UNDP/ADB | 2001 | 12.00 | C |
| | Efficient utilization of agricultural wastes | WB/ADB | 2002 | 6.40 | F |
| | Energy conservation project, phase II | WB | 2002 | 26.00 | A |
| | End use energy efficiency project | UNDP | 2003 | 17.38 | F |
| | | | | **292.92** | |
| **Indonesia** | Solar home systems (SHS) | WB | 1996 | 24.30 | C |
| | West Java/Jakarta environmental management project | WB | 2000 | 3.11 | A |
| | | | | **27.41** | |
| **Malaysia** | Industrial energy efficiency improvement project | UNDP | 1998 | 7.30 | A |
| | Biomass-based power generation and co-generation in the Malaysian palm oil industry, phase I | UNDP | 2001 | 4.03 | A |
| | | | | **11.33** | |
| **Mexico** | High efficiency lighting pilot | WB | 1992 | 10.00 | C |
| | Renewable energy for agriculture | WB | 1999 | 8.90 | A |

Key: C – Closed or completed; A – Active or ongoing; F – Future project (approved but not yet started); WB – World Bank; UNDP – United Nations Development Program

| Country | Project name | Agency | Year approved | Total GEF financing (US$ millions) | Project Status |
|---|---|---|---|---|---|
| **Mexico** | Hybrid solar thermal power plant | WB | 2000 | 49.70 | F |
| | Methane capture and use (landfill demonstration project) | WB | 2000 | 6.57 | A |
| | Demonstration project of hydrogen fuel cell buses and associated system for hydrogen supply in Mexico City, phase I | UNDP | 2001 | 5.42 | A |
| | Introduction of climate friendly measures in transport | WB | 2002 | 6.10 | A |
| | Action plan for removing barriers to the full-scale implementation of wind power | UNDP | 2003 | 4.74 | A |
| | Large scale renewable energy development project | WB | 2003 | 25.35 | F |
| | | | | **116.78** | |
| **Peru** | Technical assistance to the Centre for Energy Conservation | UNDP | 1992 | 0.90 | C |
| | Photovoltaic-based rural electrification in Peru | UNDP | 1998 | 3.96 | A |
| | Renewable energy systems in the Peruvian Amazon Region (RESPAR) | UNDP | 2001 | 0.75 | A |
| | Obtaining biofeuls and non-wood cellulose fiber from agricultural residues/waste | UNDP | 2002 | 0.99 | A |
| | Lima urban transport | WB | 2003 | 8.28 | F |
| | | | | **14.88** | |
| **Philippines** | Leyte-Luzon Geothermal | WB | 1991 | 30.00 | C |
| | CEPALCO distributed generation PV power plant | WB/IFC | 1999 | 4.03 | A |
| | Metro Manila urban transport integration project – Marikina bikeways project component | WB | 2000 | 1.48 | A |
| | Palawan new and renewable energy and livelihood support project | UNDP | 2000 | 0.75 | A |
| | Capacity building to remove barriers to renewable energy development | UNDP | 2002 | 5.45 | F |
| | Rural power | WB/UNDP | 2002 | 9.35 | F |
| | Electric cooperative system loss reduction project | WB | 2003 | 12.35 | F |
| | | | | **63.51** | |
| **Russia** | Greenhouse gas reduction | WB | 199 | 3.20 | C |
| | Capacity building to reduce key barriers to energy efficiency in Russian residential buildings and heat supply | UNDP | 1997 | 3.38 | A |
| | Cost effective energy efficiency measures in the Russian education sector | UNDP | 2003 | 1.00 | A |
| | Removing barriers to coal mine methane recovery and utilization | UNDP | 2003 | 3.30 | A |
| | Developing the legal and regulatory framework for wind power in Russia | WB/IFC | 2004 | 0.73 | A |
| | | | | **11.61** | |
| **Thailand** | Promotion of electricity energy efficiency | WB/UNDP | 1992 | 10.10 | C |
| | Building chiller replacement program | WB | 1999 | 2.50 | A |
| | Removal of barriers to biomass power generation and co-generation | UNDP | 2000 | 6.83 | A |
| | | | | **19.43** | |
| **Vietnam** | Systems efficiency improvement, equitization and renewables (SEER) project – renewables components | WB | 2002 | 4.85 | A |
| | Demand-side management and energy efficiency program | WB | 2003 | 5.72 | A |
| | | | | **10.57** | |

renewable energy alternatives. However, programs appear to have been concentrated in areas where power consumption and distribution problematic.[48]

## Outcomes

The value of GEF funding on climate change projects is relatively insignificant. Despite being structured in such a way as to combine GEF allocations with investments by other organisations, the size and scope of projects are not adequate to meet the aims of the financial mechanism. Evaluating the impact of GEF projects is similarly problematic.

From 1991 to mid-1999 the GEF approved grants totaling $706 million for 72 energy efficiency and renewable energy projects in 45 countries. A review of those projects in 2000 found that only eight were fully completed and there was insufficient evidence to measure direct or indirect impacts.[49] The paper speculated that the projects had a visible impact by the installation of renewable energy or energy efficiency systems but no quantified analysis regarding emission levels or market impacts was possible.

A review of the GEF climate change program in November 2004 found that for the 27 closed projects in the 13 years since inception, the estimated avoided direct and indirect emissions amount to 224 million metric tons carbon dioxide at an incremental cost of US$194 million.[50] Over 13 years this is a modest result, given that global emissions of energy-related carbon dioxide are predicted to reach 38 billion tons annually by 2030, with China accounting for 6.7 billion tons per year.[51]

According to the 2004 review, "individual projects may be responsible for high achievements in GHG avoidance, but have little potential for replication or sustained barrier removal."[52] The review found that the GEF had been satisfactory in fulfilling its role but that program focus and allocations have not been maximized and have not fully addressed "the *major* climate change needs, even in countries with considerable potential for benefits."[53]

The greatest progress in terms of outcomes to date has been made in the energy efficiency portfolio. The GEF aims for barrier removal strategies to lead to replication of energy efficiency measures across sectors. Achievements have been made in energy-efficient appliances and products in Mexico and Poland and industrial boiler conversion in China. Renewable energies remain more expensive and less accessible than traditional energy sources. The GEF has concentrated on promoting the increased use of photovoltaic (PV) technology with some small successes in clinics and schools. However, PV technology remains an unaffordable and inefficient option for the market at large in developing countries.

The GEF has made some progress in individual projects focusing on renewable energy and energy-efficient products. However, these projects are generally minimal in scope and impact. The PV technology and other renewable energy projects provide tangible benefits in countries where mainstream power systems and grid are undeveloped or areas within those countries without access to a power grid. There have been no major gains in improving efficiencies in use in major energy consumer countries. There is still very little evidence of the effectiveness of the GEF in terms of long-term benefits to reducing greenhouse gas emissions and facilitating adaptation in developing countries.

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48 Such an approach could produce strategic economic benefits where greater energy capacity is required for economic growth.

49 GEF, *Promoting energy efficiency and renewable energy: GEF climate change projects and impacts*, 2000.

50 GEF, *Program study on climate change*, 4 November 2004, p. iii.

51 International Energy Agency (IEA), 'In 2030, Global $CO_2$ emissions will be 70% more than today', www.iea.org/dbtw-wpd/textbase/weo/papers/Weoc02.pdf, accessed 17 November 2004.

52 GEF, *Program study on climate change*, 4 November 2004, p. iii.

53 GEF, *Program study on climate change*, 4 November 2004, p. iv.

# Bibliography


APEC (2003) APEC *energy overview* 2003, Singapore: APEC Energy Working Group.

Babiker, Mustafa H.M. and Jacoby, Henry D. (1999) *Developing country effects of Kyoto-type emissions restrictions*, MIT Joint Program on the Science and Policy of Global Change Report No. 53, Cambridge: MIT.

Babiker, Mustafa H.M., Reilly, John M. and Jacoby, Henry D. (1999) *The Kyoto Protocol and developing countries*, MIT Joint Program on the Science and Policy of Global Change Report no. 56, Cambridge: MIT.

Babiker, Mustafa H.M., Jacoby, Henry D., Reilly, John M. and Reiner, David M. (2002) *The evolution of a climate regime: Kyoto to Marrakesh*, MIT Joint Program on the Science and Policy of Global Change, Report 82, Cambridge: MIT.

Bond, G., *et al.* (2001) "Persistent solar influence on north Atlantic climate during the Holocene", *Science*, 294: 2130-2136.

Benedick, R. (2001) "Striking a new deal on climate change" in *Issues in science and technology online*, www.nap.edu/issues/18.1/.

Bernstein, P.M., Montgomery, W.D. and Rutherford, T.F. (1999) "Global impacts of the Kyoto agreement: Results from the MS-MRT model", *Resource and energy economics*, 21 (1999): 375-413.

Blanchard, O., Criqui, P., and Kitous, A. (2002) *After The Hague, Bonn, and Marrakech: The future international market for emissions permits and the issue of hot air*. Grenoble: Institut d'Economie et de Politique de l'Energie.

Bluemle, J.P., Sable, J. and Karlen, W. (2001) "Rate and magnitude of past global climate changes" in Gerhard, L.C., Harrison, W.E. and Hanson, B.M. eds. *Geological perspectives of global climate change*. AAPG Studies in Geology 47, pp. 193- 212, Tulsa: AAPG.

Brown, S., *et al.* (1999) *The Economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases*. ABARE Research Report No. 99.6. Canberra: ABARE.

Commission of the European Communities (EEC) (2003) *Report from the Commission under Council Decision 93/389/EEC as amended by Decision 99/296/EC for a monitoring mechanism of Community greenhouse gas emission*. Brussels: EEC.

Davis, J. C., and Bohling, G. (2001) "The search for patterns in ice core temperature curves", in Gerhard, L.C., Harrison, W.E. and Hanson, B.M. (eds.) *Geological perspectives of global climate change*, AAPG Studies in Geology 47, p. 213- 230, Tulsa: AAPG.

Evans, Alex (2002) *Fresh air?: Options for the future architecture of international climate change policy*. London: New Economics Foundation.

GEF, World Bank (2003) *GEF annual report*, Washington DC: World Bank.

GEF, World Bank (2004) *GEF annual report*, Washington DC: World Bank.

GEF, World Bank (2004) *Program study in climate change report*, Washington DC: World Bank GEF Office of Monitoring and Evaluation.

GEF, World Bank (2000) *Promoting energy efficiency and renewable energy: GEF climate change projects and impacts*, Washington DC: World Bank GEF.

Gerhard, L. C., Harrison, W.E. and Hanson, B.M. (2001) "Geological perspectives of global climate change: Introduction and overview", in Gerhard, L.C., Harrison, W.E. and Hanson, B.M. eds., *Geological perspectives of global climate change*: AAPG Studies in Geology 47, p. 1- 15, Tulsa: AAPG.

Gerhard, L.C. (2004) "Climate change: Conflict of observational science, theory, and politics", *AAPG bulletin*, 88(9): 1211-1220.

Houghton, J.T., *et al.* (2001) Climate change 2001: *The scientific basis: Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, published for the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press.

Hoyt, Douglas V. and Schatten, Kenneth H. (1997) *The role of the sun in climate change*, New York, Oxford University Press.

International Energy Agency (2004) *World energy outlook*, Paris: IEA.

International Energy Agency (2000) *World energy outlook 2000*, Paris: IEA.

Illarionov, A. (2004) Questions posed to Bert Bolin by Andrei Illarionov, Press Conference given by Andrei Illarionov at the Climate Change and Kyoto Protocol Seminar, Alexander House, Moscow, July 8, 2004.

International Panel on Climate Change (IPCC) (1992) *Climate change 1992: The Supplementary report to the IPCC Scientific Assessment*, Cambridge: Cambridge University Press.

IPCC (2000) *Special report on emission scenarios*. A Special report of Working Group III of the Intergovernmental Panel on Climate Change, http://www.grida.no/climate/ipcc/emission/index.htm.

Lamb, H. H. (1995) *Climate, history and the modern world*, 2d ed.: New York: Routledge

Lecocq. F., Crassous, R. (2003) *International climate change regime beyond 2012 – Are quota allocation rules robust to uncertainty?*, Working Paper, World Bank Development Economic Research Group, Infrastructure and Environment, Washington DC: World Bank.

Lomborg, Bjørn (2001) *The Skeptical environmentalist*, Cambridge: Cambridge University Press.

Mann, M.E., Bradley, R.S. and Hughes, M.K. (1998) "Global-scale temperature patterns and climate forcing over the past six centuries" *Nature*, No. 392, pp. 779-787.

Michaelowa, Axel (2001) *Rio, Kyoto, Marrakesh – groundrules for the global climate policy regime* HWWA Discussion Paper 152. Hamburg: Hamburg Institute of International Economics.

Michealowa, Axel (2004) "Book review: International emissions trading: From concept to reality: Richard Baron", *Climate policy*, Volume 3, Issue 1, Pages 1-106 (1st Quarter 2003).

Michaelowa, Axel and Jotzo, Frank (2002) "Estimating the CDM market under the Marrakesh Accords" revised draft submitted to *Climate policy*, April 2002, available at cres.anu.edu.au/~jotzo/ cdm_market_jotzo-michaelowa_april02.pdf.

McIntyre, Stephen and McKitrick, Ross (2003) "Corrections to the Mann *et al.* (1998) proxy data base and northern hemispheric average temperature series", *Energy & environment* Vol 14, No 6.

McKibbin, Warwick J. and Wilcoxen, Peter (2002) *Climate change policy after Kyoto: Blueprint for a realistic approach*. Washington DC: Brookings Institution Press.

McKibbin, Warwick J., *et al.* (1999) *Emissions trading, capital flows and the Kyoto Protocol*, Brookings Discussion Papers in International Economics, No 144, Washington DC: Brookings Institution.

Organisation for Economic Cooperation and Development (2002) *Foreign direct investment and development: Maximising benefits, minimising costs*. OECD Report, Paris: OECD.

Organisation for Economic Cooperation and Development/International Energy Agency (2004) *Taking stock of progress under the Clean Development Mechanism*, by Jane Ellis, Jan Corfee-Morlot and Harald Winkler, OECD Document Code: COM/ENV/IEA/SLT(2004) /FINAL, Paris: OECD.

Organisation for Economic Cooperation and Development (2004b) *Linking non-EU domestic emissions trading schemes with the EU emissions trading scheme*, by William Blyth & Martini Bosi, OECD Document Code COM/ENV/EPOC/IEA/SLT(2004)6, Paris: OECD.

Organisation for Economic Cooperation and Development (2004c) *Emissions trading: taking stock and looking forward*, by Cédric Philibert and Julia Reinaud, OECD Document Code COM/ENV/EPOC/IEA/SLT(2004)3.

Pearce F. (2003) "Greenhouse gas 'plan B' gaining support", exclusive from *New Scientist* Print Edition Retrieved from http://www.newscientist.com/news/news.jsp?id=ns99 994467, December 10.

Polidano, C., *et al.* (2000) *The Kyoto Protocol and developing countries: Impacts and implications for mechanisms design*," ABARE Research Report No. 2004.4, Canberra: ABARE.

Rosenzweig Richard *et al.* (2002) *The emerging international greenhouse gas market*, [Report] prepared for the Pew Center on Climate Change. Washington DC: Pew Center on Climate Change.

Saha, Pranesh Chandra. (2003) "Sustainable energy development: a development for Asia and the Pacific region in the 21st century", *Energy policy*, 31: 1051-1059.

Varilek, Matthew and Cohn, Neil (2002) "The CDM is dead, long live the CDM", paper produced by Natsource LLC for publication in *Global greenhouse emissions trader*, 11 (June): 4-5.

Schneider, Friedrich and Wagner, Alexander (2002) *What happened in Marrakech? COP-7 and recent agreements on the implementation of the Kyoto Protocol*, available at www.economics.uni-linz.ac.at/Members/Schneider/MarrakeshJune4.PDF.

Wigley, T.M.L. (1998) "The Kyoto Protocol, CO2, CO4 and climate implications", *Geophysical research letters* (25)13:2, 2285-8.

World Bank (2004) *World development indicators*, Washington DC: World Bank Group.

# Endnotes

i Gases listed in Annex A of the Kyoto Protocol.

ii Countries that must take on targets under the Protocol if they choose to ratify are listed in Annex I of the Kyoto Protocol, they are: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, the European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal. Romania, the Russian Federation, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and the United States. Note that neither US nor Australia have ratified as yet.

iii Article 3.1, Kyoto Protocol.

iv Article 10 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change, hereafter "Kyoto Protocol".

v The 21 member countries of APEC are: Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong, China, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Chinese Taipei, Thailand, United States, Viet Nam

vi Statistics taken from the APEC Secretariat website at www.apecsec.org.sg/apec/about_apec.html

vii World Bank (2004) *World development indicators*, Washington DC: World Bank Group, various tables.

viii International Energy Agency (2004) *World energy outlook*, Paris: IEA.

ix The texts of letters that Ian Castles and David Henderson sent to Dr. Pachauri at the IPCC in 2002, their presentations in Amsterdam in January 2003 and our other papers written at that time are available at http://www.economist.com/finance/displayStory.cfm?story_id=1579333 (Click on the link in the footnote to the article). This swag of documents subsequently appeared in "Energy & Environment", vol. 14, nos. 2 & 3: 159-85. The response by 15 SRES authors in the same issue of "Energy & Environment" (pps. 187-214) is available at http://crga.atmos.uiuc.edu/publications/ipcc-sres-revisited.pdf. The second article in *The Economist*, supporting the Castles/Henderson critique and criticising the IPCC, is at http://www.economist.com/finance/displayStory.cfm?story_id=2189568 A further response by 18 SRES authors will be published in "Energy & Environment, vol. 15, no. 1.

x World GDP measured at 36.3 trillion in 2003, World Bank World Development Indicators Database.

xi In US$ 2000 dollars.

xii See endnote ix, above.

xiii See Bjørn Lomborg, (2001) *The Skeptical environmentalist*, Cambridge: Cambridge University Press, p.304.

xiv Babiker, M. and Jacoby, H.D. (1999) *Developing country effects of Kyoto-type emissions restrictions*, MIT Joint Program on the Science and Policy of Global Change Report No. 53; Babiker, M., Reilly, J. and Jacoby, H.D. (1999) *The Kyoto Protocol and developing countries*, MIT Joint Program on the Science and Policy of Global Change Report no. 56.

xv Polidano, C., *et al.* (2000) *The Kyoto Protocol and developing countries: Impacts and implications for mechanisms design*, ABARE Research Report No. 2004.4.; S. Brown, D. Kennedy, C. Polidano, K. Woffenden, G. Jakeman, B. Graham, F. Jotzo, and B.S Fisher (1999), *Economic impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases*, ABARE Research Report No. 99.6.

xvi Bernstein, P.M., Montgomery, W.D. and Rutherford, T.F. (1999) "Global impacts of the Kyoto agreement: results from the MS-MRT model", *Resource and energy economics*, 21 (1999): 375-413.

xvii Babiker & Jacoby (1999); Babiker *et al.* (1999); Bernstein *et al.* (1999); Böhringer & Löschel (2001); Böhringer & Löschel (2002); Brown *et al.* (1999); McKibbin & Wilcoxen (2000); McKibbin *et al.* (1999).

xviii These conclusions are drawn from the MIT reports (Babiker & Jacoby, 1999; Babiker *et al.*, 1999) the ABARE report (Brown *et al.*, 1999) and the Charles River & Associates/Univ. of Colorado paper (Bernstein *et al.*, 1999). The results drawn from the papers are table in Annex 1.

xix United Nations Framework Convention on Climate Change (UNFCCC) 1992, Article 4 (3), (5).

xx Kyoto Protocol to the UNFCCC, Article 10(c) – FCCC/CP/1997/7/Add.1

xxi UNFCCC 1992, Article 11 (3).

xxii Kyoto Protocol to the UNFCCC, Article 11 – FCCC/CP/1997/7/Add.1.

xxiii Kyoto Protocol, Decision 3/CP.4.

xxiv UNFCCC 1992 Article 11 (5).

xxv GEF, *Program study on climate change*, 4 November 2004.

xxvi OECD, Statistical annex of the 2003 Development co-operation report.

xxvii GEF *Annual report 2003*, pp. 13, 17-18.

xxviii GEF *Annual report 2002*, p. 13.

xxix GEF, *Program study on climate change*, 4 November 2004, p. iii.

xxx International Energy Agency (IEA), In 2030, *Global CO2 Emissions will be 70% more than today*, www.iea.org/dbtw-wpd/textbase/weo/papers/Weoc02.pdf, accessed 17 November 2004.

xxxi GEF, *Program study on climate change*, 4 November 2004, p. iii.

xxxii GEF, *Program study on climate change*, 4 November 2004, p. iv.

xxxiii GEF, *Program study on climate change*, 4 November 2004, pp. 95-100

xxxiv Under the Kyoto Protocol's Article 12.

xxxv The negotiations were at the 7th meeting of the Conference of the Parties and were held in Marrakesh. The resulting documents are called the "Marrakesh Accords".

xxxvi OECD, 2004: 18.

xxxvii This is called "additionality" in the language of the Kyoto Protocol's Article 12.

xxxviii Saha (2003: 1053) cites IEA (2000).

xxxix Chart by Charles River Associates, cited by Dr Brian Flannery in a presentation "An Industry Perspective on Development and Global Commercialization of Innovative Technologies for GHG Mitigation", given in Sydney at an Esso Australia information session, 8 September 2004.